4A.3.1 Terrestrial Vegetation and Wetlands

4A.3.1.1 Alternative A – CPAI Development Plan Impacts on Terrestrial Vegetation and Wetlands

Figures 4A.3.1-1 and 4A.3.1-2 show the vegetation and habitat types potentially affected, and Table 4A.3.1-1 and Table 4A.3.1-2 summarize the area of vegetation types and habitats affected under the CPAI Development Plan, Alternative A. All impacts under Alternative A would be to wetlands. Oil spills, should they occur, would also directly or indirectly affect vegetation and wetlands in the Plan Area. The impacts of oil and chemical spills and the potential for spills in the Plan Area are described in Section 4.3.

Construction Period

Gravel Pads, Road, and Airstrips

Under Alternative A, a total of approximately 270 acres of vegetation would be covered with gravel fill approximately 5 to 6 feet thick for the construction of well pads, connecting roads, and an airstrip. Abandonment of roads, pads, and airstrips is discussed in Section 2.3. In addition to impacts from roads, pads, and an airstrip, some vegetation would be lost for the construction of a boat launch ramp at either CD-2 or CD-4 and the associated access road and a floating dock and access road at CD-3 as described in Section 2.3.8. A boat ramp and access road constructed at the CD-2 location would affect the following vegetation types: Wet Sedge Meadow Tundra, Open and Closed Low Willow Shrub, and Barrens, and the following habitat types: Patterned Wet Meadow, Nonpatterned Wet Meadow, Riverine or Upland Shrub, and Barrens. A boat ramp and access road constructed at the CD-4 location would affect the following vegetation types: Wet Sedge Meadow Tundra, Open and Closed Low Willow Shrub, and Partially Vegetated, and the following habitat types: Patterned Wet Meadow, Riverine or Upland Shrub, and Barrens. An access road constructed to a floating dock at CD-3 would affect the following vegetation and habitat types, respectively: Wet Sedge Meadow Tundra and Patterned Wet Meadow. Project facilities (roads, pads, etc.) would be situated to minimize impacts to key wetlands described in Section 3.3.1. The project design would minimize the facility footprints to reduce the loss of vegetation and habitat from gravel placement and associated secondary impacts.

Gravel for the proposed development would be mined from two locations. The ASRC Mine Site is already permitted as a gravel source with a reclamation plan in place. The reclamation plan would be amended to reopen the mine to supply material for the CD-3 and CD-4 sites. Gravel for the CD-5, CD-6, and CD-7 sites would be mined from the Clover Potential Gravel Source, approximately 6 miles southeast of CD-6. The Clover site would require permitting and a reclamation plan to be in place prior to development. The vegetation of the Clover area is composed of Wet Sedge Meadow Tundra, Tussock Tundra, and Moist Sedge Shrub. Removal of gravel from the ASRC and Clover sites would result in a temporary loss of habitat while the mine sites are active and an alteration in habitat type when the gravel sites are reclaimed. Specific details on the changes in habitat resulting from gravel extraction would be provided in a reclamation plan. The plan would be reviewed and approved by local, state (for ASRC), and federal agencies.

The type of gravel material used for pads, airstrips, and roads could also affect vegetation, especially if the material has a high salt concentration. Water (for example, rain) draining off or leaching through saline pad material dissolves the salt and could cause physiological stress to nearby plants (Simmons et al. 1983; McKendrick 1996). Salinity measurements taken from borings in the ASRC Mine Site and the Clover Potential Gravel Source ranged from 0 to 3 parts per thousand (ppt) and 0 to 9 ppt, respectively.

TABLE 4A.3.1-1 ALTERNATIVE A – SUMMARY OF SURFACE AREA (ACRES) OF VEGETATION CLASSES AFFECTED

Vegetation Classes	Colville River Delta				NPR-A (Western Beaufort Coastal Plain)			
	Loss		Alteration		Loss		Alteration	
	Roads	Pads[a]	Dust[b]	Power Line Trenching [c]	Roads	Pads[a]	Dust[b]	Power Line Trenching [c]
Water	9.960	0.000	12.404	0.000	0.141	0.000	0.215	0.000
Riverine Complex	0.000	0.000	0.000	0.000	0.604	0.000	0.748	0.000
Fresh Grass Marsh	4.347	0.000	4.361	0.000	0.000	0.000	0.000	0.000
Fresh Sedge Marsh	0.000	0.000	0.000	0.000	0.880	0.000	1.051	0.000
Deep Polygon Complex	0.000	5.821	2.275	0.000	0.000	0.000	0.000	0.000
Young Basin Wetland Complex	0.000	0.000	0.000	0.000	2.994	1.682	4.079	0.000
Old Basin Wetland Complex	0.000	0.000	0.000	0.000	5.997	0.000	7.729	0.000
Wet Sedge Meadow Tundra	13.710	38.157	28.669	0.000	16.840	12.070	22.763	0.000
Salt-killed Wet Meadow	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Halophytic Sedge Wet Meadow	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Halophytic Grass Wet Meadow	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Moist Sedge Shrub Tundra	7.553	0.000	10.550	0.000	33.350	0.000	38.773	0.000
Tussock Tundra	0.000	0.000	0.000	0.000	90.190	11.370	107.216	0.000
Dryas Dwarf Shrub Tundra	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cassiope Dwarf Shrub Tundra	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Halophytic Willow Dwarf Shrub Tundra	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Open and Closed Low Willow Shrub	1.943	0.000	2.379	0.000	3.740	2.237	4.882	0.000
Open and Closed Tall Willow Shrub	0.000	0.000	0.000	0.000	0.271	0.000	0.317	0.000
Dune Complex	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Partially Vegetated	3.336	0.000	1.126	0.000	0.000	0.000	0.000	0.000
Barrens	1.207	0.000	1.400	0.000	0.000	0.000	0.000	0.000
Total Area	**42.056**	**43.978**	**63.164**	**0.000**	**155.007**	**27.359**	**187.773**	**0.000**

Notes:

[a] Total includes gravel for pads and airstrips

[b] Dust impacts were calculated using a 36-foot buffer on roads, pads, and airstrips

[c] No powerline trenching is proposed for this alternative

Table 4A.3.1-2 Alternative A – Summary of Surface Area (Acres) of Habitat Types Affected

Habitat Type	Colville River Delta				NPR-A (Western Beaufort Coastal Plain)			
	Loss		Alteration		Loss		Alteration	
	Roads	Pads[a]	Dust[b]	Power Line Trenching[c]	Roads	Pads[a]	Dust[b]	Power Line Trenching[c]
Open Nearshore Water	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brackish Water	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Tapped Lake with Low-water Connection	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Tapped Lake with High-water Connection	4.977	0.000	6.705	0.000	0.000	0.000	0.000	0.000
Salt Marsh	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Tidal Flat	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Salt-killed Tundra	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Deep Open Water without Islands	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Deep Open Water with Islands or Polygonized Margins	3.673	0.000	4.218	0.000	0.000	0.000	0.000	0.000
Shallow Open Water without Islands	0.475	0.000	0.507	0.000	0.000	0.000	0.000	0.000
Shallow Open Water with Island or Polygonized Margins	0.000	0.000	0.000	0.000	0.030	0.000	0.087	0.000
River or Stream	0.835	0.000	0.973	0.000	0.111	0.000	0.129	0.000
Aquatic Sedge Marsh	0.000	0.000	0.000	0.000	0.880	0.000	1.051	0.000
Aquatic Sedge with Deep Polygons	0.000	5.821	2.275	0.000	0.000	0.000	0.000	0.000
Aquatic Grass Marsh	4.347	0.000	4.361	0.000	0.000	0.000	0.000	0.000
Young Basin Wetland Complex	0.000	0.000	0.000	0.000	2.994	1.682	4.079	0.000
Old Basin Wetland Complex	0.000	0.000	0.000	0.000	5.997	0.000	7.729	0.000
Riverine Complex	0.000	0.000	0.000	0.000	0.604	0.000	0.748	0.000
Dune Complex	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nonpatterned Wet Meadow	6.242	9.819	10.114	0.000	1.520	5.749	3.643	0.000
Patterned Wet Meadow	7.464	28.334	18.553	0.000	15.320	6.318	19.115	0.000
Moist Sedge-Shrub Meadow	7.553	0.000	10.550	0.000	37.030	2.237	43.590	0.000
Moist Tussock Tundra	0.000	0.000	0.000	0.000	90.190	11.370	107.216	0.000

TABLE 4A.3.1-2 ALTERNATIVE A – SUMMARY OF SURFACE AREA (ACRES) OF HABITAT TYPES AFFECTED (CONT'D)

Habitat Type	Colville River Delta				NPR-A (Western Beaufort Coastal Plain)			
	Loss		Alteration		Loss		Alteration	
	Roads	Pads[a]	Dust[b]	Power Line Trenching[c]	Roads	Pads[a]	Dust[b]	Power Line Trenching[c]
Riverine Low and Tall Shrub	0.000	0.000	0.014	0.000	0.331	0.000	0.384	0.000
Upland Low and Tall Shrub	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Upland and Riverine Dwarf Shrub[d]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Riverine or Upland Shrub[e]	1.943	0.000	2.366	0.000	0.000	0.000	0.000	0.000
Barrens (riverine, eolian, or lacustrine)	4.542	0.000	2.526	0.000	0.000	0.000	0.000	0.000
Artificial (water, fill, peat road)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Area	42.051	43.974	63.162	0.000	155.007	27.356	187.771	0.000

Notes:

a Total includes gravel for pads and airstrips

b Dust impacts were calculated using a 35-foot buffer on roads, pads, and airstrips

c No power line trenching is proposed for this alternative

d Mapped for NPR-A area only

e Mapped for Colville River Delta area only

Dust Fallout from Roads

Although much of the traffic would occur during the construction season, most would be during the winter on ice roads. However, summer traffic during construction would be required for module hookups, pipeline work, and roadwork. Summer construction traffic, which would produce the most dust, is expected to decrease after the first construction season (Johnson et al. 2003).

On heavily traveled gravel roads, the passage of vehicle traffic would result in dust and gravel being sprayed over the vegetation within about 35 feet of the road and a noticeable dust shadow out to about 150 feet or more (Walker and Everett 1987; Woodward-Clyde Consultants 1983). Accumulated dustfall has no soil structure, is massive, and often has poor aeration and limited water filtration (McKendrick 2000b). Various studies of dust fallout have found early snowmelt, reduced soil-nutrient concentrations, lower moisture, altered soil organic horizon, and higher bulk density and depth of thaw in soils affected by road dust (Everett 1980; Walker and Everett 1987; Auerbach et al. 1997). These studies reported reduced richness of plant species near the road especially in naturally acidic soils. Heavy dust accumulation can eliminate Sphagnum (Auerbach et al. 1997; Walker et al. 1985), acidophilus mosses (Walker and Everett 1987; Auerbach et al. 1997), and prostrate willow (McKendrick 2000b). Lichens are sensitive to dust and are often eliminated in high dust areas (Walker and Everett 1987). Within 35 feet of roads, the dust and gravel may smother the original vegetation, altering the plant communities, and at extreme levels may eliminate all vascular plants (Auerbach et al. 1997; McKendrick 2000b). Beyond about 35 feet, the effects of dust on vegetation decrease logarithmically with distance from the road out to about 1,000 feet. Areas beyond this distance are essentially undisturbed (Everett 1980).

Under Alternative A, potential impacts from dust would result in alteration of about 250 acres of tundra vegetation, assuming that these occur only within 35 feet of roads and pads. Tables 4A.3.1-1 and 4A.3.1-2 summarize the surface area of vegetation and habitat types affected by dust. The impacts from dust would be reduced by scheduling construction and associated traffic in the winter when dust from the road would be less, minimizing traffic flow, and watering roads during the summer (a standard North Slope practice) to keep dust down and maintain road bed integrity.

See Section 2 for a comparison of effects of dust on vegetation classes and habitat types in the Plan Area.

Ice Roads, Ice Pads, and Snow Stockpiles

Construction of ice roads and subsequent use may temporarily disturb underlying vegetation. Shrubs, forbs, and tussocks may be damaged and occasionally killed. Compaction of tundra vegetation by ice roads and associated gravel hauling and other construction activities can affect tundra habitats for several years by crushing tussocks, breaking and abrading willow terminal ends, and by altering or destroying the intertussock plant community, particularly the mosses and lichens (Walker 1996). Compaction of vegetation could also alter drainage, cause impoundment of meltwater, alter the thermal regime, and cause thaw settlement (Felix et al. 1992). Habitats sensitive to compaction include Moist Tussock Tundra, Riverine or Upland Shrub, and Moist Sedge-Shrub Meadows (Felix and Raynolds 1989a; Emers et al. 1995; PAI 2002). Vegetation in the path of the ice road remains greener longer in the fall. This indicates the effects of late-melting ice, which delays the typical plant phenology (the relationship of climate and seasonal cycle) (McKendrick 2000a, 2003). In general, more significant damage from ice roads occurs on higher, drier sites, with little or no evidence of damage to wet or moist wetland sites (BLM 2002). Shrubs and other woody species are affected the most by ice road construction (BLM 2002). Studies conducted on the effects of ice road river crossings on willow stands (McKendrick 2000a, 2003) reported impacts such as delayed phenology from lingering ice cover, broken and dead limbs, and a few dead plants. Damaged willows recovered on their own from single-year ice roads (McKendrick 2000a, 2003). Long-term vegetation modification could result from repeated use of the same location for ice road construction (BLM 2002). However, a pilot study conducted by the BLM found no apparent difference between single-year ice roads and an overlapping area from two subsequent years of ice roads (Yokel et al. undated). Offsetting ice road paths, year after year, would create a greater surface area of disturbance.

Under Alternative A, a total of 256 miles of ice roads would be constructed over the life of the project (construction and operation period combined), resulting in a maximum of approximately 1,096 acres of vegetation disturbed. This is a maximum-case scenario that assumes the ice roads would be built in a different location each year as required by existing stipulations on BLM-administered land. The maximum area covered by ice roads in a single year would be 440 acres, with an average of 180 acres per year. The actual surface area disturbed would likely be much less, especially if ice roads are overlapped in subsequent years to minimize impacts. Ice roads placed for the construction of gravel roads and pipelines would follow adjacent to the road/pipeline routes and would tend to affect the same habitat and vegetation types (see Tables 4A.3.1-1 and 4A.3.1-2). Winter ice roads would be designed and located to minimize the breakage, abrasion, compaction, or displacement of vegetation. To mitigate vegetation impacts by minimizing the surface area of disturbance, the most direct route would be taken, and, when possible, shrub areas would be avoided.

In addition to ice roads, insulated ice pads would be used as staging areas during pipeline construction. Approximately 70 acres of vegetation would be disturbed by ice pad staging areas for the construction of the pipeline. Ice pads may also be used to stockpile overburden material associated with the ASRC Mine Site and Clover Potential Gravel Source. The ice pads would be constructed directly adjacent to the mine sites and would tend to affect the same vegetation types as would gravel extraction activities from the mine sites. The size of the ice pads would depend on the depth of overburden soils and the volume of underlying gravel to be extracted. Overburden soils removed from ASRC Mine Site during previous operations required a 1-acre stockpile area for every 25,000 cubic yards of overburden (Tom Mortensen Associates 2000). Ice pads also would be constructed at each end of each proposed bridge to stage equipment. These ice pads used as staging areas would vary with the size of the bridge installation and equipment needs. Given the number of bridges proposed under the CPAI Development Plan Alternative A and assuming the maximum pad size would be 800 feet by 800 feet surrounding the abutment structure at each end of a bridge (see Section 2.3, Features Common to all Alternatives), then a maximum of 205 acres of vegetation would be affected by ice pads. Ice pads could also be built for storage of drill rigs and other equipment at remote production pads The effects of ice pads on vegetation would be similar in type to the effects of ice roads.

Snowdrifts or plowed snow that accumulates on tundra adjacent to roads, well pads, and airstrips can be deep and may persist longer than snow in areas away from gravel structures. In areas where snow persists late into the growing season, vegetation growth would be delayed. As with ice roads, typically vegetation composition is not altered in areas with late-melting snow piles, but the vegetation tends to remain green later than usual at the end of the growing season (McKendrick 2000b).

Off-Road Tundra Travel

Development and operation of oil facilities in the Plan Area may require access across tundra. Such access could be necessary to respond to spills or other emergencies, conduct pipeline maintenance and repair, facilitate ice road construction, or to transport supplies and equipment to roadless development sites.

Off-road tundra travel, especially during the summer, could cause impacts to ground stability and vegetation, including compaction, disruption of the surface layer, damage to willow cover, and scarring of the surface layer (PAI 2002). Habitats sensitive to compaction include Moist Sedge-Shrub Meadows and Wet Sedge-Willow Meadows (PAI 2002).

Most research on the effects of winter travel on tundra vegetation have focused on seismic trails (Emers and Jorgenson 1997; Emers et al. 1995; Felix and Raynolds 1998a, 1989b; Jorgenson 2000; Jorgenson et al. 1996) These studies indicate that impacts to vegetation from winter tundra travel associated with seismic exploration include temporary aesthetic impacts from visible trails and disturbance such as green trails caused by the compression of standing dead vegetation, loss of plant cover, soil exposure, some species composition change as described by Emers et al. (1995), and changes in thaw depth as described by Emers and Jorgenson (1997). Generally, these studies showed that disturbance and recovery depended on snow cover, vehicle type, traffic pattern, and vegetation type. Snow depths of at least 25 centimeters significantly decreased the initial disturbance. Heavier vehicles with higher ground contact pressure caused more initial damage and less recovery than lighter ones. Multiple vehicles on a single narrow trail caused more disturbance than dispersed tracks. Tundra that was shrub dominated or had raised microrelief had higher initial disturbance levels and slower recovery than low-relief sedge-dominated tundra. Jorgenson et al. (1996) showed that disturbance levels on winter seismic lines and camp-move trails decreased greatly over time and that the main long-term damage to tundra was from the heavier vehicles (10.5 pounds per square inch [psi]) used for camp-moves. Similar results have been reported for summer tundra travel (Lawson et al. 1978; Walker et al. 1977; Everett et al. 1985); however, the impacts from summer tundra travel can be more severe because the lack of snow makes the tundra more exposed to disturbance.

Impacts from off-road tundra travel would be mitigated and avoided by limiting the number of vehicle passes in an area, and avoiding tight turns. Low-ground-pressure vehicles (less than 4 psi) approved for travel by state and federal regulators would be used. Low-pressure vehicles such as Rolligons, Tuckers, and Nodwells would conduct these activities from the nearest pad or road. Restrictions to tundra travel are implemented by state, federal, and Native corporation regulators. All applicable permits and approvals would be obtained prior to tundra travel, and the permit stipulations would be followed. Existing procedures for emergency tundra travel would be maintained onsite during construction and operation.

Impoundments and Thermokarst

Impoundments are created where gravel fill or overburden placed on the tundra surface blocks the downslope movement of water. Although drainage plans, project design, culvert installation, and maintenance have reduced the occurrence of impoundments or ponding on the North Slope, temporary blockages are still possible. Some blockages simply increase soil moisture on the upslope side of the barrier, potentially causing the substrate to become drier on the downslope side, and others create ponds. Impoundments may be ephemeral and dry up early during the summer, or they may become permanent water bodies that persist from year to year (Walker et al. 1987a; Walker 1996). Wetland associated with ice-wedge polygons and low-lying, vegetated thaw-lake basins are more susceptible to impounding than higher, moist tundra (Walker et al. 1987a). Hydrological changes are reflected in the vegetation, with sharp contrasts in vegetation type from one side of a road to the other. Tundra plant communities have evolved under naturally changing moisture regimes, so are pre-adapted to accommodate analogous man-induced changes. Ice wedging has for millennia dried out high centers of polygons and moistened polygon troughs. Increased wetness encourages water-loving plants such as *Arctophila fulva*, *Dupontia fisheri*, *Carex aquatilis*, and *Eriophorum angustifolium*. Increased dryness encourages plants needing less moisture such as *Puccinellia langeana*, *Festuca baffinensis*, *Trisetum spicatum*, *Dryas integrifolia*, and *Salix lanata* ssp. *Richardsonii* (McKendrick 2000b). These impacts would be mitigated and avoided by locating the road and pad on the highest portions of slopes and maintaining adequate cross-drainage by using culverts. Culverts would be maintained annually to prevent ice-up.

Thermokarst is a localized thawing of ground ice resulting in a surficial depression and eventual erosion (Walker et al. 1987a). Thick road berms and elevated pipelines would help prevent melting of ground ice. However, in areas where there is a potential for a combination of road dust, flooding, and warming effects of the road, thermokarst may still occur (Walker et al. 1987a). Thermokarst occurs primarily on flat thaw-lake plains. Floodplains and terraces are usually unaffected because of the low ground-ice content in these areas (Walker et al. 1987b). The loss of the moss layer from dust fallout may play a role in the development of roadside thermokarst. Vegetation cover insulates permafrost from solar energy in the summer, and a decrease in vegetation cover may contribute to deepening of the permafrost thaw (Haag and Bliss 1974). Sphagnum, in particular, provides thermal stability to the permafrost (Clymo and Hayward 1982). Generally, thermokarst thawing of ice-rich tundra soil near the edges of gravel roads and pads may enhance plant productivity and species diversity because of increased thickness of the active layer and more available nutrients. An increase in the depth of the active layer may lead to an increase in graminoid and bryophyte production in wet habitats or a decrease in shrubs and lichens in moist or dry habitats (Woodward-Clyde Consultants 1983). However, if the thermokarst expands and prolonged and deep ponding or flooding results, adjacent vegetation communities may be lost completely (Walker et al. 1987b). At Prudhoe Bay, past practices resulted in thermokarst features that occur mostly within 80 feet of the road, but in some areas it can be seen at distances up to 330 feet (Walker et al. 1987b).

The following operation measures would greatly reduce the amount of thermokarst from the levels associated with past practices: (1) summer watering of roads and conducting most transportation of equipment and materials during the winter to reduce impacts caused by dust; (2) proper culvert installation and annual maintenance would reduce impoundments and flooding impacts; and (3) the design of thick roads and elevated pipelines to reduce warming effects.

Cross-Drainage and Water Flow

Although drainage plans, project design, culvert installation, and maintenance have helped prevent melting of the underlying permafrost and subsequent subsidence, gravel roads and pads may still intercept the natural flow of water, especially in drained thaw-lake basins, ephemeral streams, and floodplains. Impacts from cross-drainage and water flow would be greater in the Colville River Delta than in the NPR-A because the flow regimes are relatively more stable in the NPR-A and because ocean-induced storm surges would not be present near the proposed roads within the NPR-A. The disruption of sheet flow in the spring could dry up habitat on the downslope side of the roads and pads and cause the habitat on the upslope side to become wetter. These impacts would be avoided by locating the road and pads on the highest portion of slopes and maintaining adequate cross drainage with culverts. Culverts would be maintained annually to prevent ice up. Bridges are also proposed for where hydrological factors area a concern.

Air Pollution

Little is known about the sensitivity of arctic vegetation to air pollution. Previous studies have documented that plant life in general is affected by air pollution (Treshow et al. 1989; Unsworth 1982). Project construction would cause a localized and temporary impact on air quality. The sources of air pollution during the construction period would be fugitive dust from topsoil disturbance and gravel activities; exhaust from heavy construction equipment (earth movers, trucks, etc.) and drilling rigs; and emissions from electrical generators, portable light generators, small heaters, and similar temporary fuel burning equipment (PAI 2002). These sources are not expected to produce sufficient levels of pollutants to affect vegetation. No specific studies have been conducted on the effects of vehicle emissions on vegetation. Studies at Prudhoe Bay have shown no consistent differences in cover of vascular plants and lichen in response to ozone (O_3,), nitrogen dioxide (NO_2), nitrogen oxide (NO), and sulfur dioxide (SO_2) deposition, although the levels encountered were not expected to be harmful to plants (Kohut et al. 1994). The generation of fugitive dust would be minimized by conducting major construction activities in the winter when the topsoil is frozen and the ground would be covered with snow. Air quality impacts and applicable mitigation measures are discussed in Section 4A.2.3.2

Pipelines

Beside the disturbance from ice roads and staging pads for the construction of pipelines (discussed above), the only other impact to vegetation from pipeline construction is from VSM borings. Given the maximum diameter of VSM borings and the projected number to be constructed under Alternative A, about 0.5 acre of vegetation would be lost to VSM installation. The vegetation and habitat types affected would depend on the exact location of the VSM. The elevated pipeline design would reduce impacts to vegetation and habitat types.

Power Lines

Power line design (suspended between CD-6 and CD-7 and on cable trays mounted on pipeline VSMs elsewhere) would reduce the effects of power lines on vegetation and habitats. Under Alternative A, approximately 3.5 square feet of vegetation would be lost from pole placement for the suspended power line between CD-6 and CD-7.

Operation Period

The operation period includes continued drilling and day-to-day operations and maintenance once production has begun.

Gravel Pads, Roads, and Airstrips

Most loss and alteration of vegetation communities would occur during the construction period and would be related to gravel placement. Additional vegetation losses could occur during the operational period during maintenance of gravel roads (such as snow removal) or if flood events wash out portions of roads or pads and deposit gravel downstream.

Gravel that is inadvertently spread or sprayed (most commonly during snow removal) onto tundra adjacent to roads and pads also affects the vegetation. Impacts depend on site-specific conditions and the amount of gravel on tundra. Gravel spray that simply adds a scattering of stones to the tundra often stimulates the growth of vegetation, probably because of soil warming with the gravel cover, which increases the decomposition of organic matter and releases nutrients (McKendrick 2000b). The response may not appear for several years fol lowing disturbance and may persist for only a few years. Increasing thickness of gravel may kill plants; the prostrate and low-stature forms would be killed first. If gravel accumulates gradually in wet sedge meadows dominated by rhizomatous sedges, vegetation may persist even after the gravel has become 10 to 20 inches thick. The indigenous grasses and sedges keep pace with the buildup, rooting at stem bases and producing rhizomes at higher levels as the gravel thickness increases. But even in wet environments, 4 to 8 inches of gravel deposited at once may kill all plants, and recovery must occur either by invasion from the gravel margins or by seedling establishment (McKendrick 2000b). Effects of flood event washouts on vegetation would depend on site-specific conditions and the amount of gravel washed out onto tundra, but would be similar in type to the impacts described above. Impacts to vegetation from gravel and fill spreading would be mitigated by slope stabilization using revetments or soil binders.

Dust Fallout from Roads

Although traffic is expected to be higher during the construction season, over the life of the project, effects of dust from roads are expected to be greater during the operational period. The effects of dust on vegetation are described in the Construction Period section above.

Ice Roads, Ice Pads, and Snow Stockpiles

Under Alternative A, ice roads would be needed every few years during the life of the facility to support well workovers and other drilling activities at remote sites such as CD-3. Ice pads would not likely be needed during operations. The surface area of disturbance for ice road construction during the operational period is included in the total given the Construction Period discussion of ice roads. See the Construction Period discussion above for potential impacts.

As during the construction period, snowdrifts or plowed snow would accumulate on tundra adjacent to roads, well pads, and airstrips. Impacts would be similar to those discussed above in the Construction Section.

Off-Road Tundra Travel

Some off-road tundra travel would continue during the operational period to respond to spills or other emergencies, to conduct pipeline maintenance and repair, to facilitate ice road construction, or to transport supplies and equipment to roadless development sites. See the Construction Period discussion above for potential impacts.

Impoundments and Thermokarst

Although there is a potential for some habitat loss and alteration to occur from thermokarst and the creation of impoundments during the operational period of the project, these impacts are more likely to be initiated during construction. Therefore, the factors causing vegetation loss and alteration are discussed above in the Construction Period section.

Cross-Drainage and Water Flow

Cross-drainage and water flow are not expected to cause impacts to vegetation during the operational phase of this project.

Air Pollution

Air pollution levels would increase during operations with the upgrade of the existing Alpine CPF and increased emissions from traffic, drilling equipment, and well servicing equipment. However, this increase is not expected to generate levels of pollutants that would affect vegetation. Air quality impacts resulting from emis sions from well servicing and drilling equipment would be intermittent and localized. Air quality impacts and applicable mitigation measures are discussed in Section 4A.2.3.2.

Air quality monitoring and modeling data conducted at the Central Compressor Plant (main source of emissions) at Prudhoe Bay from 1989 through 1994 showed that pollutant levels were not of sufficient concentration (in both long-term averages and maximum values) to represent a hazard to vegetation (Kohut et al. 1994). The vascular and lichen plant communities monitored during the Prudhoe Bay research did not reveal any changes in species composition that could be related to differences in exposure to pollutants, and no symptoms similar to those caused by air pollutants were observed on any of the plants examined. A pattern of change in the rates of photosynthesis along the dispersion gradient was detected in one year but did not appear to be directly related to changes in levels of foliar nitrogen. Laboratory tests were conducted during this same study to assess the effects of air pollution on plant physiology of selected species (*Eriophorum angustifolium* and *Salix arctica*). These species were found to be unaffected by acute exposure to NO_2 and NO (Kohut et al. 1994). The conclusions of this study, however, do not represent a long-term assessment required to accurately assess the possible impacts of air quality on vegetation.

Pipelines

Pipeline operation would not cause vegetation losses or alteration. However, routine maintenance and occasional larger scale pipe repairs that may be required during the thawed season could result in additional damage to tundra from equipment needed to conduct the repair work. Tundra travel is discussed above. Additionally, indirect impacts (discussed above in the Construction Period section) associated with snow drifting and shading would continue to occur during the operational period.

Power Lines

No additional impacts on vegetation would occur from power lines during the operational period.

4A.3.1.2 Alternative A – Full-Field Development Impacts on Terrestrial Vegetation and Wetlands

Under the Alternative A FFD scenario, direct and indirect impacts to vegetation related to gravel fill; dust fallout from roads; ice roads and snow stockpiles; impoundments and thermokarst; cross-drainage and water flow; air pollution; pipelines; and oil and brine spills in the three facility group areas would be the same types as those described under CPAI Development Plan Alternative A. In addition to the impacts of the CPAI Development Plan, under the FFD scenario for Alternative A approximately 1,400 acres of vegetation would be covered with gravel fill. Table 4A.3.1-1 summarizes the areas of vegetation types affected under FFD Alternative A. The effects of FFD on terrestrial vegetation and wetlands would depend on the location and extent of development in specific locations within each facility group area.

Colville River Delta Facility Group

Gravel Pads, Roads, and Airstrips

In addition to habitat loss described under the CPAI Development Plan Alternative A, there would be additional vegetation loss in the Colville River Delta Facility Group from future production pads such as hypothetical production pads CD-11, 12, 14, 15, 19, 20, and 21 and their associated roads and pads. The dominant vegetation class in the vicinity of the Colville River Delta is Wet Sedge Meadow Tundra. Under the Alternative A FFD scenario, approximately 280 acres of vegetation in the Colville River Delta area would be covered with gravel fill approximately 5 to 6 feet thick for the construction of well pads, connecting roads, and airstrips. The types of disturbances and impacts to vegetation associated with gravel fill placement would be the same as those described above under the CPAI Development Plan Alternative A.

Gravel extraction for the hypothetical FFD would result in the destruction of some vegetation. Specific gravel sources for the hypothetical FFD scenario have not been identified. The development process for any future gravel source would include planning, design, permitting, temporary staging areas, removal of overburden, blasting and excavation of gravel, and an approved rehabilitation plan. Analysis of impacts and appropriate mitigation measures would be examined before approval of future mine sites.

Dust Fallout from Roads

Impacts from dust under FFD Alternative A would be similar to those described for the CPAI Development Plan Alternative A. These impacts would be felt over about 82 acres in the Colville River Delta area.

Ice Roads, Ice Pads, and Snow Stockpiles

Under FFD Alternative A in the Colville River Delta area, approximately 140 miles of ice roads would be constructed during the construction period and over the life of the project, affecting approximately 680 acres of vegetation. The maximum area covered by ice roads in a single year would be 165 acres, with an average of 110 acres per year. As with the CPAI Development Plan Alternative A, insulated ice pads would be used as staging areas during pipeline construction, to stockpile overburden material associated with gravel mine sites, for equipment staging areas for bridge installation, and for storage of drill rigs and other equipment at remote production pads. The types of impacts to vegetation associated with ice roads and pads and associated mitigation measures would be the same as those described above under the CPAI Development Plan Alternative A.

The types of impacts to vegetation associated with snow stockpiles would be the same as those described above under Alternative A for the ASDP, although the construction of more roads, pads, and airstrips would result in potential increased impacts to vegetation.

Off-Road Tundra Travel

The types of impacts from off-road tundra travel and associated mitigation measures would be similar to those described under the CPAI Development Plan Alternative A. The surface area affected would be expected to increase because of the increased length of pipeline, roads, and number of remote facilities that may require off-road tundra travel for emergencies, pipeline maintenance and repair, ice road construction, or supply transport.

Impoundments and Thermokarst

The types of impacts to vegetation associated with thermokarst and ponding would be the same as those described above under the CPAI Development Plan Alternative A. The construction of more roads and pads would result in increased impacts and alteration of vegetation communities from thermokarst and ponding.

Cross-Drainage and Water Flow

Impacts from cross-drainage and water flow would be greatest in the vicinity of the Colville River Delta because of unstable flow regimes and ocean-induced storm surges. In addition, roads would likely cross many ephemeral streams in the Colville River Delta area, and culverts would need to be installed. Culvert placement could potentially disturb sheet flow in the spring and could affect local moisture regimes. Culverts allow surface water flow, but they tend to ice up and increase flow in a small area compared to typical sheet flow.

Air Pollution

No additional processing facilities would be built in the Colville River Delta area under Alternative A. However, the increased number of vehicles and equipment associated with the production pads and roads in FFD would potentially cause more air pollution. This increase is not expected to generate levels of pollutants that would affect vegetation.

Pipelines

In addition to the impacts from the CPAI Development Plan Alternative A, a total of approximately 0.4 acre of vegetation would be lost to VSM installation under the Alternative A FFD scenario. The vegetation and habitat types affected would depend on the exact location of the VSM, which would be determined in the field. The types of impacts to vegetation associated with snow drifting or shading from the aboveground pipelines would be the same as those described above under Alternative A for the ASDP.

Power Lines

Under FFD Alternative A, power lines would be on pipeline VSMs and would not cause any additional disturbance to vegetation.

Fish-Judy Creeks Facility Group

Gravel Pads, Roads, and Airstrips

In addition to habitat loss described under the CPAI Development Plan Alternative A, there would be additional vegetation loss in the area of Fish and Judy creeks for the construction of a processing facility; production pads CD-8, 9, 10, 13, 16, 17, 18, 22, 23, 24, and 26; and their associated roads. Dominant vegetation classes in the Fish-Judy Creeks Facility Group are *Dryas* Tundra and Wet Sedge Meadow Tundra. (Table 4A.3.1-1). Under the FFD scenario, approximately 780 acres of vegetation would be covered with gravel fill in the Fish-Judy Creeks Facility Group (Table 4A.3.1-3). The types of disturbances and effects on vegetation associated with gravel fill placement would be the same as those described above under the CPAI Development Plan Alternative A.

Dust Fallout from Roads

In the Fish-Judy Creeks Facility Group, potential impacts from dust would disturb about 725 acres of vegetation. Dust fallout would cause the same types of impacts to vegetation as those described above under the CPAI Development Plan Alternative A.

Ice Roads, Ice Pads, and Snow Stockpiles

Under Alternative A for FFD in the Fish-Judy Creeks Facility Group, approximately 120 miles of ice roads would be built during construction and over the life of the project, affecting about 590 acres of vegetation. The maximum area covered by ice roads in a single year would be 110 acres, with an average of 60 acres per year. The types of impacts to vegetation associated with ice roads and snow stockpiles would be the same as those described above under Alternative A for the ASDP, although the construction of more roads, pads, and airstrips would result in potentially greater impacts to vegetation.

Off-Road Tundra Travel

The types of impacts from off-road tundra travel and associated mitigation measures would be similar to those described under the CPAI Development Plan Alternative A. The surface area affected would be expected to increase because of the longer pipeline and roads and the number of remote facilities that may require off-road tundra travel for emergencies, pipeline maintenance and repair, ice road construction, or supply transport.

Impoundments and Thermokarst

The types of impacts to vegetation associated with thermokarst and ponding would be the same as those described above under the CPAI Development Plan Alternative A. The construction of more roads and pads would result in increased impacts and alteration of vegetation communities from thermokarst and ponding.

Cross-Drainage and Water Flow

The types of impacts to vegetation associated with cross-drainage and water flow would be the same as those described above under Alternative A for the ASDP, although the construction of more roads and culverts would cause increased impacts to vegetation communities from disturbance of local water flow.

TABLE 4A.3.1-3 ALTERNATIVE A – SUMMARY OF VEGETATION IMPACTS FOR FFD

Vegetation Classes	Colville River Delta				Fish-Judy Creeks Facility Group				Kalikpik-Kogru Rivers Facility Group			
	Acres (%) in Colville River Delta		Gravel (acres)	Dust (acres)	Acres (%) in Fish-Judy Creeks		Gravel (acres)	Dust (acres)	Acres (%) in Kalikpik-Kogru		Gravel (acres)	Dust (acres)
Riverine Complex	0	(0.0%)	0	0	30	(0.1%)	1	0	0	(0.0%)	0	0
Fresh Grass Marsh	56	(0.3%)	1	0	278	(0.6%)	5	5	49	(0.3%)	1	1
Fresh Sedge Marsh	3	(0.0%)	0	0	3343	(7.5%)	59	54	1483	(8.8%)	30	23
Deep Polygon Complex	550	(2.6%)	7	2	4833	(10.9%)	85	79	1493	(8.9%)	30	23
Young Basin Wetland Complex	0	(0.0%)	0	0	2013	(4.5%)	35	33	721	(4.3%)	15	11
Old Basin Wetland Complex	0	(0.0%)	0	0	1261	(2.8%)	22	21	0	(0.0%)	0	0
Wet Sedge Meadow Tundra	9494	(44.1%)	123	36	9856	(22.1%)	173	160	6533	(39.0%)	133	100
Salt-Killed Wet Meadow	1633	(7.6%)	21	6	0	(0.0%)	0	0	0	(0.0%)	0	0
Halophytic Sedge Wet Meadow	1210	(5.6%)	16	5	0	(0.0%)	0	0	0	(0.0%)	0	0
Halophytic Grass Wet Meadow	32	(0.1%)	0	0	0	(0.0%)	0	0	0	(0.0%)	0	0
Moist Sedge Shrub Tundra	782	(3.6%)	10	3	4318	(9.7%)	76	70	0	(0.0%)	0	0
Tussock Tundra	139	(0.6%)	2	1	14936	(33.5%)	262	243	5452	(32.5%)	111	84
Dryas Dwarf Shrub Tundra	29	(0.1%)	0	0	238	(0.5%)	4	4	0	(0.0%)	0	0
Cassiope Dwarf Shrub Tundra	0	(0.0%)	0	0	395	(0.9%)	7	6	284	(1.7%)	6	4
Halophytic Willow Dwarf Shrub Tundra	8	(0.0%)	0	0	0	(0.0%)	0	0	0	(0.0%)	0	0
Open and Closed Low Willow Shrub	1929	(9.0%)	25	7	520	(1.2%)	9	8	1	(0.0%)	0	0
Open and Closed Tall Willow Shrub	0	(0.0%)	0	0	172	(0.4%)	3	3	0	(0.0%)	0	0
Dune Complex	0	(0.0%)	0	0	902	(2.0%)	16	15	185	(1.1%)	4	3
Partially Vegetated	1183	(5.5%)	15	5	412	(0.9%)	7	7	154	(0.9%)	3	2
Barrens	4487	(20.8%)	58	17	1030	(2.3%)	18	17	411	(2.5%)	8	6
Totals	**21536**	**(100.0%)**	**280**	**82**	**44537**	**(100.0%)**	**780**	**725**	**16768**	**(100.0%)**	**342**	**257**

Notes:

The proportion of vegetation types within the hypothetical circles in each facility group area and the approximate acres of vegetation disturbed by gravel fill and dust were used to distribute the number of acres affected across vegetation types (assuming the vegetation types in the hypothetical circles are the distribution of habitats to be affected by the FFD Alternative A scenario).

Air Pollution

The construction of an additional processing facility would result in increased levels of air pollution that could affect vegetation in the vicinity of Fish and Judy creeks, as described in the CPAI Development Plan Alternative A.

Pipelines

In the FFD scenario of Alternative A, VSM placement would cause the loss of approximately 1.2 acres of vegetation in the vicinity of the Fish-Judy Creeks Facility Group.

Power Lines

Power lines would be placed on cable trays on pipeline VSMs and would not cause any additional disturbance to vegetation.

Kalikpik-Kogru Rivers Facility Group

Gravel Pads, Roads, and Airstrips

In addition to habitat loss described under the CPAI Development Plan Alternative A, approximately 342 acres of vegetation would be affected in the Kalikpik-Kogru rivers area for the construction of a hypothetical processing facility; production pads CD-25, 27, 28, and 29; and their associated roads and airstrips. The dominant vegetation classes in the Kalikpik-Kogru Rivers Facility Group are Tussock Tundra and Sedge/Grass Meadow (BLM and Ducks Unlimited, 2002) (Table 4A.3.1.1-1). The types of disturbances and impacts to vegetation associated with gravel fill placement would be the same as those described above under Alternative A for the ASDP sites.

Dust Fallout from Roads

The Kalikpik-Kogru Rivers Facility Group could result in disturbance of about 257 acres of vegetation from potential impacts of dust. The types of impacts to vegetation from dust fallout would be the same as those described above for the CPAI Development Plan Alternative A.

Ice Roads, Ice Pads, and Snow Stockpiles

FFD Alternative A area would result in approximately 98 miles of ice roads being built during construction and over the life of the project, affecting about 475 acres of vegetation. The maximum area covered by ice roads in a single year would be 145 acres, with an average of 115 acres per year. The types of impacts to vegetation associated with ice roads and snow stockpiles would be the same as those described above under Alternative A for the ASDP, although the construction of more roads, pads, and airstrips would result in potentially greater effects on vegetation.

Tundra Travel

The types of impacts from off-road tundra travel and associated mitigation measures would be similar to those described under the CPAI Development Plan Alternative A. The surface area affected would be expected to increase because of the increased length of pipeline and roads and the number of remote facilities that may require off-road tundra travel for emergencies, pipeline maintenance and repair, ice road construction, or supply transport.

Impoundments and Thermokarst

The types of impacts to vegetation associated with thermokarst and ponding would be the same as those described above under the CPAI Development Plan Alternative A. The construction of more roads and pads would result in increased impacts and alteration of vegetation communities from thermokarst and ponding.

Cross-Drainage and Water Flow

The types of impacts to vegetation associated with cross-drainage and water flow would be the same as those described above under Alternative A for the ASDP, although the construction of more roads and culverts would cause increased impacts to vegetation communities from disturbance of local water flow.

Air Pollution

The construction of an additional processing facility would result in increased levels of air pollution that could affect vegetation, as described in the CPAI Development Plan Alternative A.

Pipelines

In the FFD scenario for Alternative A, VSM placement would cause the loss of approximately 0.6 acre of vegetation in the vicinity of the Kalikpik-Kogru Rivers Facility Group . The types of impacts to vegetation associated with snow drifting or shading from pipeline placement would be the same as those described above under Alternative A for the ASDP.

Power Lines

Power lines would be placed on cable trays on pipeline VSMs and would not cause any additional disturbance to vegetation.

4A.3.1.3 Alternative A – Summary of Impacts (CPAI and FFD) on Terrestrial Vegetation and Wetlands

Impacts from the CPAI Development Plan Alternatives A to vegetation and habitat types are summarized in Tables 4A.3.1-1 and 4A.3.1-2, respectively. Impacts from FFD Alternative A are summarized in Table 4A.3.1-3.

4A.3.1.4 Alternative A – Potential Mitigation Measures (CPAI and FFD) for Terrestrial Vegetation and Wetlands

Potential mitigation measures would be similar for the CPAI Development Plan Alternative A and FFD Alternative A.

Gravel Pads, Roads, and Airstrips

Further salinity analysis would be performed before gravel extraction, and the appropriate measures, such as planting salt-tolerant vegetation, would be incorporated into the reclamation plan.

Fill slopes would be stabilized by revetments or soil binders.

Ice Roads, Ice Pads, and Snow Stockpiles

The most direct ice road route would be taken to minimize disturbance.

Shrub areas would be avoided where possible.

Off-Road Tundra Travel

The numbers of vehicle passes in an area would be limited.

Tight turns would be avoided.

4A.3.2 Fish

The CPAI Development Plan Alternative A (Figure 2.3.3.1-1) involves constructing and operating a network of production pads, roads, and pipelines and an airstrip to produce hydrocarbon reserves in the Colville River Delta and Fish Creek Drainage (Figure 2.3.3.1-1). Within the Plan Area, the primary concern is maintaining winter habitat, which is the most critical habitat to arctic fish (see Section 3.3.2. Other high priorities are maintaining suitable feeding and spawning areas and the ability to access these areas, which are often in different geographic locations (for example, broad whitefish spawn in river channels whereas drainage and frequent flooding of perched lakes provide overwintering and rearing areas). Key issues on fish habitats and populations include the effects of water withdrawal; alteration of flow patterns; release of contaminants during the life of the project; alteration to water quality, especially during winter; and the impacts of oil spills.

Impacts of and measures to prevent, control, and mitigate spills are not addressed in this section, but are discussed in Section 4.3. Further, that section includes an assessment of the project effects on marine fish and habitats. Normal construction and operation impacts for this alternative would not be expected to have measurable impacts on Harrison Bay and nearshore Beaufort Sea environments and biota.

4A.3.2.1 Alternative A – CPAI Development Plan Impacts on Fish

Construction Period

Roads, airstrips, pipelines, and pads would be constructed during winter, and well drilling operations could occur year-round. If construction were to occur in high-density spawning and overwintering areas, or during summer in migratory corridors, it could affect a relatively large number of freshwater and migratory fish. Potential impacts of construction under those conditions would include degradation or loss of overwintering habitat, partially blocked access to and from summer feeding and wintering areas, and siltation in or near these habitats. The scope of such impacts may range up to spawning failure and/or fish mortality.

However, pad and road construction is likely to have no measurable adverse effect on arctic fish populations because construction is scheduled to occur in winter in low-diversity areas sparsely inhabited by large fish and not during times when migratory fish are moving to and from freshwater habitats. Further, construction has been designed to minimize siltation effects and impacts on fish passage. Pad and road construction may kill some of the smaller resident fish (such as ninespine stickleback), but most fishes are likely to move into other areas during construction; thus the overall effects are considered insignificant.

Water Withdrawal

The main potential effect of construction on fish would be from water withdrawal to support construction of drill pads, roads, and airstrips. Water would be needed for building ice roads along the proposed pipeline route and for camp operations. In addition to water withdrawal, CPAI will use frozen lakes for ice chips.

Water removal from lakes could potentially affect fish populations. Water removal is especially critical in late winter. Deep-water lakes provide critical habitat for overwintering fish. During the arctic winter, fresh water may freeze 6 to 7 feet deep, eliminating all free water in shallow lakes and ponds and greatly reducing the unfrozen areas of deeper lakes. Those lakes deep enough to permit under-ice withdrawals for construction are also likely to support overwintering fish (Figure 4A.3.2-1). Bacterial respiration in the decomposition of lake sediments outstrips the limited oxygen production of algae and other plants, so the dissolved oxygen may be depleted to the extent that fish are not able to survive. Consequently, it is important to protect the habitat that deeper lakes provide. Excessive winter water withdrawal from lakes with water levels that are barely to moderately sufficient to support overwintering fish may further reduce the oxygen pool and potentially eliminate fish populations. Figure 3.3.2.2-1 shows the fish-bearing lakes in the Plan Area and indicates which contain fish that are not resistant to the low dissolved oxygen concentrations that may result from water withdrawal.

A total of 18 lakes have been identified in the CD-3 area as potential sources of winter water for ice road construction and other uses (Figure 4A.3.2-1, Table 4A.3.2-1). Of these, 11 contain fish populations (Table 4A.3.2-1), and water withdrawal thus would be restricted.

TABLE 4A.3.2-1 SUMMARY OF FISH PRESENCE AND ESTIMATED AVAILABLE WINTER WATER IN LAKES IN THE CD-3, CD-4, CD-5, CD-6, AND CD-7 AREAS

Lake	GIS Est. Acreage	Max Depth (feet)	Calculated Volume (mil gals)	15% Vol. >7 feet (mil gals)	Specific Conductance (µS/cm)	TDS (mg/L)	Volume Available (mil gals)	Fish Confirmed
CD-3 Area (CPAI 2002)								
M9713	14.5	11.0	17.3	0.1	3,302.0	1,640	17.3	No
M9712	52.5	8.1	46.2	0.0	3,767.0	2,180	46.2	No
M9313	128.3	25.1	349.7	19.7	759.0	370	19.7	Yes
M0019	5.4	10.8	6.3	0.0	584.0	296	6.3	No
L9903	8.3	22.9	20.7	1.0	836.0	486	1.0	Yes
L9905	7.4	12.4	10.0	0.1	5,860.0	3,470	10.0	No
L9904	12.5	25.3	34.4	2.0	622.0	354	2.0	Yes
L9210	117.1	29.1	370.1	24.3	243.0	170	24.3	Yes
L9908	9.5	11.3	11.7	0.1	250.6	130	11.7	No
L9906	14.7	13.0	20.8	0.3	416.4	238	0.3	Yes
L9108	112.2	17.1	208.4	6.4	1,867.0	800	6.4	Yes
L9907	11.2	10.1	12.3	0.1	1,405.0	128	12.3	No
M9709	64.6	18.9	132.5	5.0	301.9	4,254	5.0	Yes
M9626	20.1	20.3	44.3	1.9	245.7	144	1.9	Yes
M9522	19.9	9.0	19.5	0.0	4,290.1	2,482	19.5	No
L9281	43.8	13.5	64.2	1.1	345.5	202	1.1	Yes
M9321	20.8	11.7	26.4	0.3	146.1	88	0.3	Yes
L9279	19.1	12.7	26.3	0.4	192.5	190	0.4	Yes
CD-4 Area (CPAI 2002)								
L9323	84.1	23.2	397.7	10.90	74	53	10.90	Yes
L9324	126.1	13.0	463.2	2.45	55	95	2.45	Yes
L9325	32.5	17.3	60.5	5.40	102	62	5.40	Yes
M9524	129.7	11.4	159.0	9.20	115	--	9.20	Yes
M9525	103.6	4.2	46.8	0.00	348	--	0.00	Yes
M9929	11.5	13.8	17.1	1.30	108	52	1.30	Yes
CD-5 Area (L.L. Moulton unpublished)								
L9601	54.9	2.5	14.9	--	--	--		ns
N77097	869.8	6.0	566.9	--	199.6	--		Yes

TABLE 4A.3.2-1 SUMMARY OF FISH PRESENCE AND ESTIMATED AVAILABLE WINTER WATER IN LAKES IN THE CD-3, CD-4, CD-5, CD-6, AND CD-7 AREAS (CONT'D)

Lake	GIS Est. Acreage	Max Depth (feet)	Calculated Volume (mil gals)	15% Vol. >7 feet (mil gals)	Specific Conductance (µS/cm)	TDS (mg/L)	Volume Available (mil gals)	Fish Confirmed
CD-6 Area (L.L. Moulton unpublished)								
M9912	34.8*	9.6*	61.9*	--	97.1*	55*	61.90	No
M9913	20.0	7.9	29.8*	0.02*	85.9	74*	?	No*
M9924	47.9	3.4	17.7	--	217.2	194		Yes
MC7917	312.5	12.9	605.9	12.37	--	48	12.37	Yes
CD-7 Area (L.L. Moulton unpublished)								
M0022	38.0	6.5	26.8	--	96.2	84	26.8	No
M0023	16.4	3.9	6.9	--	191.8	128	6.9	No
M0024	141.1	8.2	236.9	--	112.5	70		Yes
M9903	70.2	22.1	168.5	8.06	87.3	126	168.50	No
M9904	25.2	9.3	25.5	0.06	209.8	61	25.50	No
M9905	24.6	11.3	30.2	0.25	85.2	112	30.20	No
M9910	146.5	9.0	306.4	2.51	126.6	84	2.51	Yes
M9914	151.1	7.8	205.1	--	90.0	61		Yes
M9915	30.6	7.1	33.7	0.01	88.7	120	33.70	No
M9922	195.9	6.1	246.9	--	159.2	140		Yes
M9923	255.0	6.7	289.6	--	264.9	136		Yes
R0070	114.1	3.6	44.6	--	266.2	--		NS
R0071	90.3	2.7	26.5	--	124.1	--		NS

Notes:

Lake volumes for L9210 and M9313 updated with 2000 depth data.

Lake volumes for L9323 and L9324 updated based on contour mapping with 2001 data.

Water chemistry: some lakes have multiple years of measurements; most recent year is included.

mil gals = million gallons

µS/cm = microsiemens per centimeter

TDS = total dissolved solids

mg/L = milligrams per liter

-- = not calculated or no measurement taken

NS = not sampled

In the CD-4 area, a total of six lakes have been identified as potential freshwater sources, with perched lakes L9323 and L9324 planned to be used for that purpose (Figure 4A.3.2-1, Table 4A.3.2-1). All have low specific conductance (that is, they are freshwater lakes), and all have been confirmed as fish overwintering sites.

According to Figure 4A.3.2-1, two lakes in the vicinity of CD-5 (L9601 and N77097) have been permitted for water use. However, both of these are less than 7 feet deep and would ultimately freeze to the bottom during winter (Table 4A.3.2-1), thus there will be no fish present.

Four lakes in the vicinity of the CD-6 satellite have been permitted for water use (Figure 4A.3.2-1, Table 4A.3.2-1). Of these, Lake MC7917 is by far the largest and is known to support least cisco. A total of 12.37 million gallons of water can safely be removed from this lake, according to permit criteria.

Thirteen lakes in the CD-7 area have been permitted for water use (Figure 4A.3.2-1, Table 4A.3.2-1). Other permitted lakes may also be used as water sources. Two of these have been reported to contain fish species that are not resistant to low dissolved oxygen concentrations that may result from water withdrawal (Figure 3.2.2.2-1). Arctic grayling (Moulton 2000a, 2002) and least cisco (Moulton 2002) were reported as captured from Lake M9910. Lake M9914 was reported to have contained Arctic grayling (Moulton 2003, unpublished).

Best management practices (BMPs) implemented by federal and state agencies commonly provide protection by monitoring withdrawals through a sampling program that ensures water quality standards are met and by limiting water withdrawal to 15 percent of the estimated free water volume (that is, excluding ice) in lakes 7 feet deep or deeper. Additional drawdown is possible if no fish sensitive to water withdrawal are known to inhabit the lake or if the applicant demonstrates that use beyond 15 percent would cause no harm. Lakes less than 7 feet deep that are interconnected with streams are also in need of protection when inhabited by fish.

CPAI will monitor each water withdrawal to ensure winter water use does not exceed permit limits and that water quality standards are met. In addition, to minimize impacts on fish, large and deep lakes would be targeted as water sources to allow a margin of safety for maintaining sufficient water volumes. Shallow lakes that do not contain fish also will be used as water sources before they freeze. No impacts to fish are expected if CPAI adheres to the water withdrawal permit conditions.

Gravel Mining

To provide road and pad material, gravel will be mined at locations to be determined. The existing ASRC Mine Site and the Clover Potential Gravel Source are sites being considered as gravel sources. In addition to mining, related activities include gravel mine pits, blasting of frozen gravel (to allow loading and transportation), and gravel stockpiling. Such activities in or near overwintering and spawning habitat are likely to adversely affect fish by reducing the amount and quality of available habitat. Direct and indirect impacts to fish from gravel extraction are most likely to occur within the floodplains of rivers. Detrimental effects could include loss of spawning and overwintering habitat (if not identified before extraction); blocking and rerouting of stream channels; high silt concentrations resulting in reduced primary production, loss of invertebrate prey species, mortality of fish eggs and larvae, and disruption of feeding patterns for sight-dependent feeders (BLM 1989). If the aforementioned activities occur outside overwintering or spawning areas, little or no adverse effects on fish would be expected.

A mitigation that may yield long-term benefits after project completion is conversion of the gravel pits to fish habitat. To allow the gravel pit basin to be colonized by fish in the same manner as other ponds in the region, a connection to another fish-bearing body of water would be excavated. Such excavation would affect terrestrial biota. The existing ASRC Mine Site is a potential candidate for such fish habitat creation after project completion. Habitat creation would involve connecting the ASRC Mine Site to the Colville River, approximately 0.15 mile away. At its closest, the boundary of the Clover Potential Gravel Source appears to be approximately 0.22 mile from the Ublutuoch River, to which it would have to be connected to create another potential fish habitat. The associated impacts to terrestrial biota as well as the engineering constraints in digging a 0.22-mile channel may be prohibitive. To be a viable candidate for fish habitat creation, these and any gravel mine sites that may be used for the project must be sufficiently near a fish-bearing body of water so that digging a connection between the gravel pit and the water body is not prohibitive.

Pipelines

The pipeline crossing the Nigliq Channel will be on the road bridge, and bridges will carry the pipeline across three channels between CD-1 and CD-3; the potential impacts of bridges are discussed below. Other water crossings along the proposed pipeline alignment are not wide enough to require pipeline bridges. Pipelines will span the crossings on VSMs. The construction of pipelines on VSMs at waters supporting fish may displace small numbers of fish short distances as a result of temporary disturbance. However, those fish affected could soon reoccupy that habitat upon completion of the activities and would be otherwise unaffected. Given that construction activities are in the winter and overwintering habitats would be largely avoided, it is expected that pipeline construction under Alternative A would have no measurable effect on arctic fish populations in the Planning Area.

Pads, Roads, and Airstrips

Gravel placed for production pads, roads, and airstrips may eliminate some fish habitat. Generally, proposed pads and gravel roads have been situated to avoid lakes and drainages in the Plan Area.

Near CD-3, the primary fish habitats that are likely to be affected include a small pond and wetland that would be crossed by the airstrip and potentially Lake M9313, which is immediately north of the pad and airstrip facilities (Figure 4A.3.2-1). The pond and wetland area are too shallow to be used year-round, but ninespine stickleback may use the area during summer. The area covered by gravel fill would be lost as stickleback habitat.

Construction of an ice road or an airstrip on fish overwintering areas may cause water to freeze to the bottom and form a barrier to water circulation, resulting in reduced dissolved oxygen levels, even if water were not withdrawn. This could have lethal effects on the overwintering fish affected by the barrier. Therefore, to mitigate impacts, ice roads and airstrips should avoid known fish overwintering areas.

Fish movement is minimal in most of the Plan Area during winter because most of the access channels between deep water bodies are frozen to the bottom. Watercourses that may support overwintering fish (such as the Nigliq Channel and Ublutuoch River) will be spanned by bridges. Therefore, winter construction of production pads, roads, and pipelines is not expected to result in any obstructions to fish passage.

Another impact related to production pads, roads, and airstrip construction is erosion and subsequent instream sedimentation. Destructive effects are similar to those from gravel mining and would be prevalent in river systems. All members of the biotic community could be affected. Potential effects of sedimentation on benthic macroinvertebrates, which are prey species for fish, include interference with respiration and interruption of the capability of filter feeders (such as aquatic insects) to secure food. A more important effect on benthic invertebrates would be smothering of physical habitat (the streambed) by heavy sediments. A loss of interstitial space in the substrate would be highly detrimental to burrowing species. A decrease in abundance could be expected in these situations. In arctic environs, where fish depend on summer food sources to grow and, if food is abundant, to reproduce, a reduced prey base may preclude fish from directing energy towards spawning.

Direct threats to fish from sediment include changes to physical habitat, subsequent decreased reproductive success, and loss of rearing habitat. Physical habitat changes from sediments are most often attributed to finer-sized particles. Developing eggs can be smothered and newly hatched fry can be killed by suspended sediment that prevents emergence from spawning gravels and interferes with respiration. Sediments fill interstitial spaces and essential winter habitat used by juvenile fish. Filling of pool habitat further limits overwintering sites for adult and juvenile fish. In instances where stream reaches are aggrading because of heavy sediment loading, physical habitat is further degraded when flows are redirected and erode channel banks.

Sublethal impacts to fish from sedimentation are a further concern in streams. Effects such as avoidance, reduced feeding, gill damage, and lessened tolerance to disease can combine to reduce fitness and survival. Habitat fouling would be especially detrimental if it occurred in a critical habitat segment of a river.

CPAI would remove snow from the road surface to minimize runoff, road erosion, and tundra silting during the spring melt. However, as a mitigation measure, silt fencing (or an equivalent measure) would be installed, routinely inspected, and properly maintained at any sites where silt may enter a water body.

Bridges

Even shallow lakes and connecting small waterways are used by fish in the summer season as migration corridors and feeding habitat. Because of this, a combination of culverts and bridges has been incorporated in the road design of this alternative to ensure free passage of fish within area waterways and habitats. These water crossings are integral features to road development. Culverts are addressed in the following subsection. CPAI has proposed to install bridges at seven sites where roads would cross water bodies:

A 1,200-foot bridge across the Nigliq Channel between CD-2 and CD-5

An 80-foot bridge across Lake 9305, between CD-2 and CD-5

A 40-foot bridge approximately 1.3 miles south of CD-5, between CD-5 and CD-6, across a channel extending north from Oil Lake (N77097)

A 120-foot bridge across the Ublutuoch River, between CD-5 and CD-6

A 40-foot bridge approximately 0.8 mile west of the Ublutuoch River, between CD-5 and CD-6

A 40-foot bridge approximately 1.1 miles east of CD-6, between CD-5 and CD-6

A 40-foot bridge approximately 1.4 miles east of CD-7, between CD-6 and CD-7.

Detailed bridge design has not been completed. These bridges would be constructed in winter when most of the water bodies that would be crossed are frozen, and fish would therefore not be present when construction occurs. Furthermore, for all road bridges except the Nigliq Channel crossing, in-channel piers are not required. Because of this, at those locations, no fish habitat losses or alterations are expected from bridge construction at these sites.

The Nigliq Channel and the Ublutuoch River do not completely freeze, and both bridge crossing sites are known fish overwintering areas. As noted above, instream piers are not required at the Ublutuoch River crossing, thus mitigating impacts to the main channel. However, at the Nigliq Channel and Ublutuoch River, if the bridge spans only the main channel and if gravel approaches are in the floodplain terrace(s), fish habitat will be altered and fish movements disrupted.

Figure 2.3.9.1-2 shows that the Nigliq Channel Bridge would have two instream piers, each with icebreaking structures. Each of the two instream piers would have four piles, and each icebreaking structure would have three piles. Thus 14 borings would be required and would produce cuttings consisting of all soil materials encountered during drilling. The cuttings would be hauled by truck back to the location of gravel sources used for gravel road construction and placed in the waste-material area of the pit. Whereas most of the cuttings from the pier borings would be collected and hauled away by truck, it is likely that some fraction would escape and produce temporary turbidity plumes in at least the bottom to mid-depth water layers. Review of salinity data presented in Moulton (2001) shows a pronounced density gradient separating lighter water above from denser water below. This density gradient can be present in this region of the channel at about the 0.5- to 1-meter water depth from the overlying ice, and it can be strong enough to prevent mixing of dissolved oxygen levels throughout the water column. Turbidity plumes from the drilling of the support piers could suspend oxygen-demanding materials in the bottom and mid-depth water layers, potentially decreasing dissolved oxygen levels in those layers to levels stressful and/or lethal to fish. These materials would not be swept away because there is expected to be no or only minimal flow in the Nigliq Channel in winter.

If the Nigliq Channel bridge spans the main channel but not the floodplain; a significant portion of the floodplain terrace to the west of the channel would be bisected by gravel fill. Because construction will be in winter, the floodplain will be under neither water nor ice, and thus no impacts of gravel placement are expected.

At the Nigliq Channel Bridge, if a region of low dissolved oxygen were to develop at the bottom and mid-water depths around the bridge following its construction (from drilling of pilings and suspension of sediments), this anomaly could create a physiological barrier and temporarily obstruct winter fish movement through the area. Fish from downstream areas might not be able to move upstream and vice versa; this may result in overcrowding, with potential adverse effects over time as fish use up dissolved oxygen (since water is not flowing). Construction noise may also pose a barrier to fish movement during the winter of construction.

This area of the Nigliq Channel has emerged as a highly significant fishing area. Effort has gradually shifted downstream in the Nigliq Channel during 15 years of monitoring (Moulton 2001). In 1993, fishing effort in the middle part of the Nigliq Channel exceeded that in the upper Nigliq area for the first time, and in 2000 about 37 percent of the total Nigliq Channel fishing effort was in the middle Nigliq Channel near the proposed bridge site. If dissolved oxygen levels were depleted in this region, a substantial fraction of the available winter habitat may be rendered unusable and result in a temporary displacement of the fishery and/or temporary loss of important subsistence fishery resources.

Culverts

CPAI has proposed to install culvert batteries instead of bridges at five sites where roads would cross water bodies:

Across the narrow portion of Lake 9323 just north of CD-4

Approximately 1 mile south of CD-5

Approximately 1.8 miles west of the Ublutuoch River, between CD-5 and CD-6

Approximately 3 miles west of the Ublutuoch River, between CD-5 and CD-6

Approximately 2 miles southwest of CD-6

A detailed culvert crossing design has not been completed, but the design will meet the objectives of maintaining water flow/connectivity and ensuring freedom of fish movement. CPAI intends to incorporate into its culvert designs the Culvert Installation Standards in the Alaska Administrative Code (5 AAC 94.260). Proper design would require knowledge of fish species present and the water velocities at flood stage of each watercourse.

The gravel bed supporting the 32-foot-wide road would eliminate a corridor of benthic habitat at each culvert battery crossing (Figure 2.3.1.1-1). At Lake 9323 near CD-4, this corridor would be approximately 90 feet wide. This constitutes a negligible portion of the total fish habitat available in this lake.

Bottom disturbance during culvert installation, plus sediments associated with the gravel, would increase suspended sediments (see above for discussion of sedimentation impacts) and possibly decrease dissolved oxygen levels. Reduced dissolved oxygen from the combination of water withdrawal and culvert installation could potentially eliminate the fish residing in water bodies during the winter of construction if they cannot avoid the sediments. Visual interference is not expected to be significant, as these fish are not feeding during winter.

Operation Period

Pipelines

The normal operation of the pipelines should have only negligible effects on fish habitat or fish movement corridors. Fish habitat would not be lost or altered by the presence of VSM-mounted pipes. Because most planned maintenance and repair activities would occur in the frozen season to allow ground access to pipelines even where there are no adjacent roads, little impact would be expected. Should urgent repairs be needed when the ground is not frozen, impacts should be negligible where the pipeline is adjacent to the road (that is, to CD-4, CD-5, CD-6, and CD-7). Along the pipeline to CD-3, which would not be adjacent to a road, vehicular access for emergency maintenance would necessitate traveling over unfrozen tundra; however, effects on fish would still be expected to be minimal and short term (for example, minor sedimentation as low-ground-pressure vehicles passed through drainages)

Pads, Roads, and Airstrips

During high-water periods, fish may use low-lying areas that are covered with water. Therefore, even at locations remote from defined watercourses, gravel production pads, roads, and airstrips potentially may alter water flow patterns on a landscape scale and thus impede fish passage to and within water bodies. They can also interfere with migrations to spawning, feeding, and overwintering sites if improperly designed. CPAI could install bridges or culverts in road beds in low-lying areas to ensure fish passage under high-water conditions.

Least cisco have been documented to use Lake M9313 near CD-3, and ninespine stickleback likely use the pond and wetland area crossed by the airstrip. The main route of fish migration into and out of Lake M9313 is thought to be through a small channel on the northeast side of the lake. A connection between the lake and the West Ulamnigiaq Channel in this area is established when the river channel complex in this region is overtopped during high water. Because this area is remote from the proposed production pad and road, it is not likely that there would be any impacts on fish movements into or out of the lake and wetland area. Access to the wetland area in question is likely from the north through the same wetland complex connecting Lake M9313 to the river channel.

The proposed road and production pad in the CD-4 area could alter some flow entering or leaving three nearby perched lakes—M9524, L9323, and L9324—and thus affect movements of fish including broad whitefish and least cisco. Thus, any changes in flow patterns that disrupt migration routes, particularly during break-up, could reduce or increase the number of broad whitefish and least cisco entering or leaving the lakes for the duration of the project.

Maintenance of road surfaces at or near lake crossings could increase the amount of suspended sediments in the lakes, resulting in degradation of water quality and fish habitat. Failure of any portion of the road within the lake and subsequent repairs also would be expected to degrade water quality and fish habitat within the lake.

Bridges

If bridges do not span the Nigliq Channel and Ublutuoch River floodplains, but rather include in their design gravel bridge approaches across the floodplain terraces, the normal flood-stage hydrology of the two watercourses would be altered.

At the Nigliq Channel, hydrologic constraints have been considered for constructing the floodplain segment of the road (on the west side of the channel). The road has been designed to accommodate a 200-year return flood event, plus 1 foot of freeboard. Other hydrologic factors that are being considered include scour protection, ice jams, and storm surges. The considerations should prevent bridge or road failure. However, if the bridge or road in this area did fail, the primary impacts would be related to oil spills. Potential impacts from spills are addressed in Section 4.3. Also, debris resulting from a bridge failure potentially could be an additional flow disruption and could obstruct fish movements in the main channel.

Extending the road across the floodplain terrace on the west side of the Nigliq Channel would constrict the channel, which would result in increased flows and likely scouring of the bottom during flood events. This could severely alter floodplain vegetation. The constriction of the channel may also increase the likelihood of ice jams, followed by flooding, then by pulse floods down the channel when the ice jams break up. These events would adversely alter fish habitat in the vicinity of the bridge. If ice jams occur, fish could be dispersed over the floodplain as water levels rose and then be stranded when the ice jam broke up. Substantial numbers of fish could be affected because the Nigliq Channel is a major overwintering site.

Impacts to the floodplain at the Ublutuoch River crossing, where there are terraces on either side of the main channel, would be similar to those at the Nigliq Channel bridge. Building the Nigliq Channel and Ublutuoch River bridges so that they span the floodplain terrace(s) in addition to the main channel would mitigate these impacts.

Flow around the instream piers at the Nigliq Channel bridge would be altered; however, the effects would be minimal and would not result in an impact on fish or on fish habitat. Features such as these piers often attract and hold fish.

Culverts

Current concerns related to pad and road placement include diverting or eliminating flow from small tributaries that connect lakes or that connect lakes and rivers. Potential loss of migratory capacity could stress or kill fish if the fish were unable to migrate to food-rich habitat in the summer, reach spawning areas, or move into overwintering habitat. Proper placement of culverts is critical in minimizing impacts to fish.

The culverts proposed for this project will be designed to maintain adequate water flow and fish passage. Historically, culverts have been prone to failure, but more than two decades of experience have led to greatly improved performance. Examples of problems in maintaining adequate flows for fish passage during past oilfield development include placement of undersized culverts and perching of culverts. In such cases, or if culverts clog with debris, impounding will result; downstream flow will be blocked, creating a new lake or pond and eliminating tundra habitat. In addition, culverts on the North Slope have frequently caused downstream channel morphology changes. This has the potential to eliminate considerable habitat downstream of the culverts.

Should culverts fail to be properly maintained or meet their intended goals, access by fish to critical summer rearing grounds could be restricted or lost.

Human Access

The project could create a limited number of new jobs, which may attract new residents from Barrow or other North Slope villages to reside permanently in Nuiqsut and use local fishery resources. The expected small magnitude of the potential increase in subsistence users that would be attributable to the development makes it unlikely that there would be adverse effects on the subsistence fishery. Furthermore, the project would not increase fishing competition between residents and local non-residents because CPAI has agreed to apply a no-fishing/hunting policy to non-resident workers.

Construction of roads during winter could encourage local fisherman to fish the Ublutuoch fish overwintering area as well as Fish and Judy creeks. This could result in a more than negligible increase of fishing pressure on overwintering fishes.

Theoretically, the new road could provide easier access from the Colville River Delta to the area of new development. However, there is no road access from Nuiqsut to the new road. There is potential for increased access to the lower Ublutuoch River during winter when fish are concentrated in the lower river for wintering and spawning (Morris 2003, pers. comm.). However, the no-fishing or hunting policy for non-resident workers would prevent others from using fish resources along or near the new road. Therefore, the new road should not result in increased human access and harvest of fish. Conversely, because local subsistence users tend to avoid areas near industrial activity, there may be some decreased use of some traditionally used areas because of the proximity to oilfield facilities.

4A.3.2.2 Alternative A – Full-Field Development Plan Impacts on Fish

Types of impacts of future development in the Plan Area generally will be similar to those described above for the five-pad CPAI proposal (Section 4A.3.2). However, development on the scale postulated will, depending on precise siting, destroy or alter fish habitat substantially more than CPAI's proposed plan. Overwintering, rearing, migration, and spawning habitats would be affected.

The road and pipeline network could subtly alter flows of waterways on a landscape scale that could lead to unexpected shifts in drainage and loss of fish resources. Impacts to fish passage would be minimized by installation of culverts or bridges as determined during future permitting efforts. However, culvert failure (Section 4A.3.2) could cause widespread habitat alteration and obstruction of fish movement.

The extent of road development under this scenario, including a road to or near Nuiqsut, suggests that there would be increased potential for human access to fish resources throughout the Plan Area, thus creating greater pressure on fish populations. Conversely, some traditional users of the area may chose other locations to avoid industrial activity altogether.

State-of-the-science construction and operation approaches would be used to minimize impacts, and human access to resources could be controlled as described in Section 4A.3.2. Withdrawal of fresh water necessary to support this scale of infrastructure development plus well drilling should not affect fish if withdrawals are done in compliance with permit restrictions. The effects of this FFD scenario are expected to be similar to effects from similar current developments.

The following subsections summarize concerns specific to facility groups.

Colville River Delta Facility Group

In the Colville River Delta, seven new production pads are hypothesized. Of particular note are production pads CD-19 and CD-21, on the eastern side of the outer Delta, which are in vicinity of the commercial (Helmericks) fishery as well as subsistence fisheries. Spills, addressed in Section 4.3, would be a major concern of these two hypothetical facilities.

No roads are hypothesized in this part of the Plan Area. Pipelines would be constructed over several major watercourses including the Elaktoveach Channel, Kupigruak Channel, Tamayayak Channel, and the main stem of the Colville River. Instream construction activities at these water bodies would have the potential to cause impacts as described in Section 4A.3.2.

Fish-Judy Creeks Facility Group

Eleven new pads plus one new processing facility in the Fish Creek watershed (including Judy Creek and the Ublutuoch River) are hypothesized.

Several facilities would be situated in sensitive areas designated by BLM and MMS (1998a): hypothetical production pads CD-8, CD-23, CD-24 and processing facility APF-2 in the Fish and Judy creeks drainages and CD-18 near the Colville River. Fish habitats in these drainages are important for spawning, migration, rearing, and overwintering for anadromous and resident species. This may affect subsistence fishing, because local subsistence users do not like to fish near development, especially industrial—thus they do not want oil company structures near where they fish.

The road network of this hypothetical development is extensive. If roads are not routed along high ground to the extent possible, relatively large areas of fish habitat may be affected during road construction. The roads from CD-7 to CD-25 and from CD-6 to CD-22 are perpendicular to the primary drainage flow and thus may function as dams on a landscape scale, disrupting natural hydrology and obstructing fish movement over a wide area. Bridges or culverts installed in low-lying areas might mitigate this effect.

Kalikpik-Kogru Rivers Facility Group

Four new pads and one new processing facility in the Kalikpik-Kogru rivers drainages are hypothesized.

As with the Fish-Judy Creeks Facility Group, the road network of this hypothetical development is extensive. Therefore, relatively large areas of fish habitat could be affected during road construction if roads are not routed along high ground to the extent possible. The road from CD-25 to APF-3 is perpendicular to the primary drainage flow and thus may function as a dam on a landscape scale, disrupting natural hydrology and obstructing fish movement over a wide area. Bridges or culverts installed in low-lying areas might mitigate this effect.

4A.3.2.3 Alternative A – Summary of Impacts (CPAI and FFD) on Fish

Within the Plan Area, the primary impacts of concern are those that affect winter habitat, as well as those affecting feeding and spawning areas and access to these areas. Water withdrawal for winter construction could create overcrowding and reduce the available pool of dissolved oxygen in a water body, possibly resulting in fish mortality. Permit limits on amounts of water withdrawn are set to avoid such impacts. Low dissolved oxygen may also result from suspension of oxygen-demanding materials during construction of the Nigliq Channel bridge.

Pad, road, and pipeline construction are likely to have no measurable adverse effect on arctic fish populations. Construction of ice roads or airstrips on fish overwintering areas may cause freezing to the bottom and block fish movement. The new road system may facilitate increased human access to fishing areas, potentially increasing subsistence fishing pressures.

Gravel mining would most likely have direct impacts if located within the floodplains of rivers. Sedimentation from erosion could affect fish and other aquatic organisms by interfering with respiration and vision and by smothering benthic habitat. However, gravel mines within floodplains can also result in new deep lakes that provide valuable fish habitat.

If bridge approaches at the Nigliq Channel, other major Colville River channels, or the Ublutuoch River extend into the floodplain terrace(s), altering flow and blocking fish passage during flood stage, there would be likely adverse effects on the floodplain vegetation, thus ultimately affecting fish. The long network of roads may result in alteration of regional surface hydrology, including interruption of fish movements.

If culverts (proposed in five locations) fail, water may be impounded; this would create a new pond or lake upstream of the culvert and diminish flow downstream, interrupting fish movement. Stream morphology changes may occur downstream of culverts as a result of altered flow.

Release of contaminants over the project duration and the impacts of oil spills are important concerns to fish resources; these issues are addressed in Section 4.3.

Essential Fish Habitat

The primary Essential Fish Habitat (EFH) concerns in Alternative A include potential effects on salmon associated with water withdrawal, alteration of flow patterns (for example, by bridge approaches in floodplains), release of contaminants, project-induced erosion, and oil spills.

Potential impacts of oil spills are addressed in Section 4.3. Effects of water withdrawal have been mitigated by restricting the withdrawals to permitted levels established to afford protection to resident fish. Further, monitoring of these withdrawals is planned to ensure that permitted levels are not exceeded.

Bridges would be used at the major stream and lake crossings as described in Section 2.3.10, and culverts would be installed in other areas. These actions would ensure accessibility among area habitats. Contaminants would be released, but a strong commitment to spill and emissions control has been made, as described previously. Salmon would not be expected to be present in the Nigliq Channel in winter; therefore, construction of the Nigliq Channel bridge would not be expected to affect EFH.

Project-induced erosion would be minimized by construction methods and design. Project facilities such as pads and roads would be situated on high ground to the extent possible and designed to minimize potential erosion (armoring, wing-walls at bridge abutments, etc. — see Section 2). However, roads, culvert failure, and bridge approaches within river terraces could alter hydrology.

Overall, the potential for adverse impacts on salmon EFH exists, particularly from the placement of bridge approaches within river terraces. A finding on EFH will be made following additional project design.

4A.3.2.4 Alternative A – Potential Mitigation Measures (CPAI and FFD) for Fish

- At project completion, gravel mines should be converted to fish habitat if practicable.
- The Nigliq Channel and Ublutuoch River bridges should be constructed so that they span the floodplain terrace(s) in addition to the main channel. If engineering constraints prevent this, as approved by the Authorizing Officer (AO), culverts must be installed in any bridge approaches that extend across a floodplain terrace to ensure maintenance of natural hydrological regimes.
- Ice roads and airstrips should avoid fish overwintering areas.
- Silt fencing (or an equivalent measure) should be installed, routinely and frequently inspected, and properly maintained at any sites where silt may enter a water body.

4A.3.3 Birds

Potential impacts to birds associated with construction and operation of the proposed development include habitat loss, alteration, or enhancement; disturbance and displacement; obstructions to movement; and mortality. To determine the level of effect for each proposed action, we evaluated the densities of bird species and species groups around the area of each proposed development and determined the number of nests or birds potentially exposed to the action. We also evaluated preferred habitats affected by each action and weighted effects for each bird species or species group based on their preferred habitat. The construction period includes gravel placement, grading of the gravel surface, placement of all facilities, and initial drilling. The operation period includes continued drilling and day-to-day operations and maintenance once production has begun. Oil spills also may directly or indirectly affect birds in the Plan Area. Impacts of oil and chemical spills and the potential for spills in the Plan Area are described in Section 4.3.

Before we describe the individual alternatives, there are general patterns of effects that the proposed actions would have on birds and their habitats; these are described under Alternative A for each species or species group and are summarized in Table 4A.3.3-1. In most cases, effects would involve a few individuals and would be localized, and no adverse effects to populations would be expected. Habitat loss does not involve the direct loss of active nests because winter gravel placement, ice road construction, snow dumping, and snow-drifting take place when nests are not active. In some cases, nesting structures covered by gravel would have been reused in subsequent years; when this occurs, birds would be displaced to adjacent suitable habitats (Troy and Carpenter 1990; Johnson et al. 2003a).

4A.3.3.1 Alternative A – CPAI Development Plan Impacts on Birds

Table 4A.3.3-2 presents the number of potential nests displaced by habitat loss or alteration and disturbance for CPAI Development Plan Alternative A by bird species and species group.

Waterfowl and Loons

Studies conducted in the CD-3 area found that several white-fronted geese, tundra swans, long-tailed ducks, and red-throated loons nested in the immediate area of the proposed production pads and airstrip (Johnson et al. 2003a). In the CD-4 area, white-fronted geese, tundra swans, northern pintails, Pacific loons, and yellow-billed loons nested near the proposed pad and access road (Burgess et al. 2003a). Studies conducted in the NPR-A found that white-fronted geese, northern pintails, and/or long-tailed ducks nested in the areas where gravel placement is proposed for CD-5, CD-6, and CD-7 (Burgess et al. 2003b). Yellow-billed loons in the NPR-A portion of the Plan Area are concentrated in the Fish Creek drainage and are generally not associated with the CD-5 and CD-6 sites (Burgess et al. 2003b). A yellow-billed loon nest was in a lake immediately northeast of the CD-7 site (Burgess et al. 2003b; ABR, unpublished data). In the CD-5, CD-6, and CD-7 areas, white-fronted goose, king eider, long-tailed duck, northern pintail, and Pacific loon nests were found along or near the proposed road routes near these sites (Burgess et al. 2002b, 2003b). No waterfowl or loon nests were reported near the proposed Clover Potential Gravel Source (Burgess et al. 2003b).

Construction Period

<u>Habitat Loss, Alteration, or Enhancement</u>

Winter placement of gravel during construction would account for most of the direct habitat lost or altered by Alternative A. Approximately 270 acres would be covered by gravel and lost as potential nesting, brood-rearing, and foraging habitat for waterfowl and loons during the construction of the project. Habitat losses from gravel fill would be long-term. A total of nine waterfowl nests and one loon nest (based on nesting densities found in the areas of proposed pad and road placement) would be affected by gravel placement. Habitats important to waterfowl and loons that would be covered by gravel are presented in Table 4A.3.3-3.

TABLE 4A.3.3-1 SUMMARY OF POTENTIAL EFFECTS OF THE PROPOSED DEVELOPMENT ON BIRD GROUPS

	WATERFOWL	LOONS	PTARMIGAN	RAPTORS AND OWLS	SHOREBIRDS	SEABIRDS	PASSERINES
Habitat Loss, Alteration. or Enhancement							
Loss from gravel placement	N, BR, F, St	N, BR, F, St	N, BR, F, W	N, BR, F	N, BR, F, St	N, BR, F, St	N, BR, F
Loss or gain from dust fallout	Loss- N Gain - F		Loss- N Gain - N, F	Loss- N Gain - F	Loss- N Gain - F	Loss- N Gain - F	Loss- N Gain - F
Temporary loss from ice roads	N, F	N, F	N, F	N, F	N, F	N	N, F
Change from structures	Loss - predator gain	Loss - predator gain	Loss - predator gain	Gain - Perches	Loss - predator gain	Both loss and gain	Both loss and gain
Alteration by garbage resources	Loss - predator gain	Loss - predator gain	Loss - predator gain	Loss - predator gain	Loss - predator gain	Gain - F	Both loss and gain
Disturbance and Displacement							
Disturbance by air traffic	Loss - N, BR, F, St	Loss - N, BR, F, St		Loss - N, BR, F, St		Loss - N, BR, F, St	
Disturbance by vehicle traffic	Loss - N, BR, F, St	Loss - N, BR, F, St	Loss - N, BR, F, W		Loss - N, BR, F	Loss - N, BR, F, St	Loss - N, BR, F
Disturbance by intentional hazing	Loss - N, BR, F, St	Loss - N, BR, F, St				Loss - N, BR, F, St	
Disturbance by facility noise	Loss - N, BR, F, St	Loss - N, BR, F, St				Loss - N, BR, F, St	
Disturbance by people on pads and tundra	Loss - N, BR, F, St	Loss - N, BR, F, St	Loss - N, BR, F, W	Loss - N, BR, F	Loss - N, BR, F, St	Loss - N, BR, F, St	Loss - N, BR, F, St
Obstruction of Movements							
Obstruction by roadways	Loss - BR, M	Loss - BR	Loss - BR		Loss - BR	Loss - BR	
Mortality							
Mortality from collisions	Loss - N, BR, F, St	Loss - N, BR, F, St	Loss - N, BR, F, W	Loss - N, BR, F	Loss - N, BR, F, St	Loss - N, BR, F, St	Loss - N, BR, F, St
Mortality from depredation	Loss - N, BR, M	Loss - N, BR	Loss - N, BR, F, W	Loss - N, BR	Loss - N, BR	Loss - N, BR	Loss - N, BR

Notes:

N = nesting

BR = brood-rearing

F = foraging

St = Staging

W = Winter

M = Molting

TABLE 4A.3.3-2 CPAI ALTERNATIVE A – POTENTIAL BIRD NESTS DISPLACED BY HABITAT LOSS OR ALTERATION AND DISTURBANCE

	Nests Loss Due to Gravel Placement						Habitat Alteration		Disturbance	
Species	**CD-3**	**CD-4**	**CD-5**	**CD-6**	**CD-7**	**Total**	**Dust**	**Ice Roads**	**Airstrip Buffer[a]**	**Total**
Waterfowl and Waterbirds										
Greater white-fronted goose	1.7	0.6	1.1	1.1	0.8	5.3	1.5	2.4	3.9	13.1
Snow goose	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canada goose	0.0	0.0	0.5	0.4	0.3	1.1	0.4	0.6	0.1	2.3
Brant	0.3	0.0	0.3	0.2	0.1	0.9	0.2	0.3	0.2	1.6
Tundra swan	0.1	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.5	0.8
Mallard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern shoveler	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.3
Northern pintail	0.0	0.1	0.1	0.2	0.2	0.7	0.3	0.5	0.6	2.0
Green-winged teal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
Greater scaup	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
Lesser scaup	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
King eider	0.0	0.0	0.1	0.1	0.1	0.3	0.1	0.2	0.0	0.6
Long-tailed duck	0.2	0.0	0.1	0.2	0.1	0.7	0.2	0.4	0.5	1.7
Waterfowl Total	**2.4**	**0.9**	**2.1**	**2.2**	**1.7**	**9.2**	**2.8**	**4.5**	**6.1**	**22.7**
Loons										
Red-throated loon	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.2	0.6
Pacific loon	0.1	0.1	0.2	0.2	0.2	0.8	0.3	0.5	0.6	2.1
Yellow-billed loon	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.3
Loon Total	**0.3**	**0.1**	**0.2**	**0.3**	**0.2**	**1.1**	**0.4**	**0.6**	**0.9**	**3.0**
Ptarmigan										
Willow ptarmigan	0.1	0.2	0.1	0.2	0.1	0.7	0.3	0.5	0.8	2.3
Rock ptarmigan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ptarmigan Total	**0.1**	**0.2**	**0.1**	**0.2**	**0.1**	**0.7**	**0.3**	**0.5**	**0.8**	**2.3**
Seabirds										
Parasitic jaeger	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.3
Long-tailed jaeger	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.3
Glaucous gull	0.1	0.0	0.1	0.1	0.1	0.4	0.1	0.2	0.1	0.8
Sabine's gull	0.1	0.0	0.0	0.1	0.1	0.3	0.1	0.1	0.0	0.4
Arctic tern	0.1	0.1	0.1	0.1	0.1	0.4	0.2	0.3	0.5	1.3
Seabird Total	**0.3**	**0.1**	**0.2**	**0.3**	**0.3**	**1.3**	**0.4**	**0.7**	**0.8**	**3.1**
Shorebirds										
Black-bellied plover	0.3	0.2	0.2	0.7	0.6	2.0	0.9	1.5	0.0	4.5
American golden-plover	0.4	0.3	0.4	0.6	0.3	1.9	0.7	1.1	0.0	3.7
Bar-tailed godwit	0.1	0.1	0.2	0.3	0.1	0.7	0.2	0.4	0.0	1.4
Semipalmated sandpiper	3.3	2.8	1.7	3.7	2.9	14.4	6.2	10.0	0.0	30.6
Baird's sandpiper	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.3
Pectoral sandpiper	6.3	5.4	3.0	3.8	3.2	21.6	8.4	13.5	0.0	43.5
Dunlin	0.2	0.2	0.4	0.6	0.4	1.8	0.7	1.1	0.0	3.6
Stilt sandpiper	0.3	0.2	1.3	0.6	0.4	2.9	0.8	1.3	0.0	5.0
Buff-breasted sandpiper	0.0		0.0	0.4	0.3	0.7	0.4	0.7	0.0	1.8

TABLE 4A.3.3-2 CPAI ALTERNATIVE A – POTENTIAL BIRD NESTS DISPLACED BY HABITAT LOSS OR ALTERATION AND DISTURBANCE (cont'd)

	Nests Loss Due to Gravel Placement						Habitat Alteration		Disturbance	
Species	CD-3	CD-4	CD-5	CD-6	CD-7	Total	Dust	Ice Roads	Airstrip Buffer[a]	Total
Long-billed dowitcher	0.5	0.4	1.5	2.1	1.6	6.1	2.3	3.7	0.0	12.1
Red-necked phalarope	1.6	1.3	1.5	2.4	2.2	8.9	3.3	5.4	0.0	17.6
Red phalarope	1.1	0.9	1.0	0.7	0.6	4.3	1.6	2.5	0.0	8.4
Shorebird Total	**13.9**	**11.9**	**11.2**	**15.9**	**12.7**	**65.6**	**25.6**	**41.3**	**0.0**	**132.5**
Passerines										
Yellow wagtail	0.1	0.1	0.0	0.1	0.0	0.2	0.1	0.2	0.0	0.5
Savannah sparrow	0.4	0.3	0.0	0.4	0.4	1.5	0.7	1.1	0.0	3.3
Lapland longspur	6.3	5.4	3.6	7.7	6.0	29.0	11.8	19.1	0.0	60.0
Common redpoll	0.1	0.1	0.0	0.4	0.2	0.7	0.3	0.5	0.0	1.6
Passerine Total	**6.8**	**5.8**	**3.6**	**8.5**	**6.7**	**31.5**	**13.0**	**21.0**	**0.0**	**65.5**

Notes:

[a] No disturbance affect from the Alpine airstrip was demonstrated for shorebirds or passerines (Johnson et al. 2003a)

TABLE 4A.3.3-3 ALTERNATIVE A – SUMMARY OF AFFECTED HABITAT TYPES USED BY WATERFOWL AND LOONSA

Habitat Type	Colville Delta						NPR-A			
	Acres in Colville river Delta[b]	Loss or Alteration[c] (Acres and %)		Waterfowl (10 species)			Acres in NPR-A[d]	Loss or Alteration[c] (Acres and %)	Waterfowl (9 species)	
				Nesting (10)	Brood-rearing (10)	Staging (3)			Nesting	Brood-rearing (6)
Open Nearshore Water	2,476					1	840			
Brackish Water	1,614			2	6	2	331			
Tapped Lake with Low-water Connection	5,342				3	1	420			
Tapped Lake with High-water Connection	5,132	12	(0.2%)	1	4		17			
Salt Marsh	4,090			1	1	1	902			
Tidal Flat	13,841					1	2,021			
Salt-killed Tundra	6,336			5		1	35			
Deep Open Water without Islands	5,132			2	7		12,343			5
Deep Open Water with Islands or Polygonized Margins	191,756	8	(0.0%)	5	6	1	8,950		3	3
Shallow Open Water without Islands	499	1	(0.2%)		1		1,737		1	
Shallow Open Water with Island or Polygonized Margins	133			1	2		2,824		4	1
River or Stream	20,280	2	(0.0%)			1	1,525			
Aquatic Sedge Marsh	32						2,854	2	3	2
Aquatic Sedge with Deep Polygons	3,267	8	(0.2%)	8	3		74			
Aquatic Grass Marsh	358	9	(2.4%)		1		487		1	1
Young Basin Wetland Complex							623	9		

TABLE 4A.3.3-3 ALTERNATIVE A – SUMMARY OF AFFECTED HABITAT TYPES USED BY WATERFOWL AND LOONS[A] (CONT'D)

Habitat Type	Colville Delta						NPR-A			
	Acres in Colville river Delta[b]	Loss or Alteration[c] (Acres and %)		Waterfowl (10 species)			Acres in NPR-A[d]	Loss or Alteration[c] (Acres and %)	Waterfowl (9 species)	
				Nesting (10)	Brood-rearing (10)	Staging (3)			Nesting	Brood-rearing (6)
Old Basin Wetland Complex	2						15,118	14	2	1
Riverine Complex							687	1		
Dune Complex							1,876			
Nonpatterned Wet Meadow	10,265	26	(0.3%)	4			5,305	11	1	1
Patterned Wet Meadow	25,361	54	(0.2%)	8			19,487	41		
Moist Sedge-Shrub Meadow	3,262	18	(0.6%)	2			39,920	83	1	
Moist Tussock Tundra	630						47,101	209	3	
Riverine Low and Tall Shrub				1			1,794	1		
Upland Low and Tall Shrub							692			
Upland and Riverine Dwarf Shrub[b]							2,217			
Riverine or Upland Shrub[c]	6,815	4	(0.1%)							
Barrens (riverine, eolian, or lacustrine)	19,440	7	(0.0%)				1,690			
Artificial (water, fill, peat road)	96						0			
Total Area	136,323	149	(0.1%)				171,869	370		

Notes:

[a] Numbers of species using habitats by life history stage.

[b] Mapped for NPR-A area only

[c] Total includes gravel for pads and airstrips and area affected by dust

[d] Mapped for Colville River Delta area only

Tundra adjacent to gravel fill would also be temporarily affected by snowdrifts, gravel spray, dust fallout, thermokarst, and ponding (Walker et al. 1987b; Walker and Everett 1987; Walker 1996; Auerbach et al. 1997). Snowdrifts or plowed snow that accumulates on tundra adjacent to roads, well pads, and airstrips would cause a temporary loss of waterfowl foraging habitat and would preclude waterfowl nesting if snow persists beyond normal nest initiation dates. Dust deposition and associated early snowmelt can cause early green-up on tundra adjacent to roads, providing foraging habitat available for early-arriving waterfowl (Murphy and Anderson 1993; Troy Ecological Research Associates [TERA] 1993; Noel et al. 1996). This snow-free band of tundra may be approximately 30 to 100 meters in width with changes in vegetation type within 11.7 meters (35 feet) (Auerbach et al. 1997; Klinger et al. 1983;Walker and Everett 1987). Ponding created by gravel structures, ice roads, or snowdrifts may become permanent water bodies that persist from year to year or they may be ephemeral and dry up early during the summer (Walker et al. 1987b; Walker 1996). Ponding may create new feeding and brood-rearing habitat that may be used by some waterfowl and loons (Kertell 1993, 1994). Placement and maintenance of culverts in roadways eliminates or mitigates the formation of ponding. The proposed mine site would add aquatic habitat that may be suitable for use by waterfowl and loons.

Ice roads and ice pads built during the winter to support construction activities would also affect habitat for nesting waterfowl if a delayed melt alters surface water flow or reduces the availability of tundra nesting habitat. This loss or alteration of habitat would be temporary, and its effect on nesting birds would not likely last longer than the summer after construction and use of the ice road. Habitat alterations may include changes in tundra vegetation from use of low-ground-pressure vehicles during summer or winter, these changes are unlikely to affect waterfowl and loons.

Water withdrawal from permitted water sources for the construction of ice roads likely would not affect nesting waterfowl because of State of Alaska permitting restrictions regulating the volume of water that may be withdrawn from each lake and the recharge of ponds and wetlands by snowmelt runoff in spring (Rovansek et al. 1996; Burgess et al. 2003b; Baker 2002).

Under Alternative A, approximately 33 miles of pipeline would be installed for transfer of production oil, gas, and water. New pipelines would be elevated a minimum of 5 feet above the tundra, and pipeline construction would occur during the winter when loons and waterfowl are not present in the Plan Area. Snowdrifts downwind from the pipeline would alter habitat by later melt and potential alteration of surface flow. Elevated pipelines would not be expected to contribute significantly to direct habitat loss, although they would cross an area of known loon and waterfowl concentrations in the CD-5 area. The pipeline between CD-3 and CD-1 would pass through known nesting and brood-rearing yellow-billed loon habitat (Johnson et al. 2003b).

Alternative A includes seven bridges and five culvert batteries to be constructed over several rivers, lakes, and unnamed drainages, the largest of which would span the Nigliq Channel of the Colville River. In the CD-4 area, a road crossing may affect some nesting waterfowl at a lake north of the site where tundra swans, northern pintails, and yellow-billed loons have nested (Burgess et al. 2003a).

Disturbance and Displacement

Disturbance and displacement related to Alternative A would likely displace some nesting waterfowl and loons near the proposed airstrip at the CD-3 site. Studies at the Alpine Development Project indicate that greater white-fronted geese may move to adjacent habitats if suitable habitat is available (Johnson et al. 2003a). Disturbance and displacement related to vehicular traffic would affect waterfowl and loons along the proposed road system connecting CD-4 with CD-1 (Burgess et al. 2003a). Disturbance related to vehicular traffic would also affect waterfowl and loons along the roadway to the CD-5, CD-6, and CD-7 sites (Burgess et al. 2003b). In the CD-5 area, the white-fronted goose is a common nesting species near the site of the proposed road, along with small numbers of ducks, including king eiders (Burgess et al. 2003b). Nest densities of waterfowl and loons were 15.3 nests/km^2 in the wetlands in the CD-5 area; in contrast, few waterfowl and loon nests were reported in the CD-6 (2.7 nests/km^2) and CD-7 (4.6 nests/km^2) areas (Burgess et al. 2003b).

Because gravel will be placed during the winter when waterfowl and loons do not occur on the Arctic Coastal Plain, no waterfowl or loon nests would be disturbed or displaced by this activity. Some waterfowl and loons would be disturbed during the summer breeding season by vehicular, aircraft, and boat traffic; noise from equipment on roads or at facilities; and pedestrian traffic. Disturbance by vehicles, equipment activities such as road grading and compaction or aircraft during summer would decrease the numbers of waterfowl nesting, brood-rearing or foraging in areas adjacent to roadways and airstrips (Ward and Stehn 1989; Murphy and Anderson 1993; Johnson et al. 2003a).

On the North Slope, vehicular traffic, including large trucks hauling cranes and other equipment, and road maintenance equipment had greater effects on geese feeding close to roads than on geese feeding farther away (Burgess and Stickney 1992; Murphy et al. 1988; Murphy and Anderson 1993). Disturbances to bird activity occur most often during the pre-nesting period, when birds gather to feed in open areas near roads, and during brood-rearing and fall staging. A small percentage of birds may walk, run, or fly to avoid vehicular disturbances (Murphy and Anderson 1993). Disturbance reactions occur most often within 50 meters of roads (Murphy and Anderson 1993). Disturbance from vehicular traffic may affect activity and energy budgets of waterfowl and loons and could have negative impacts on nesting success for some birds by increasing the length of time birds are away from the nest during incubation (Johnson et al. 2003a). Brood-rearing greater white-fronted geese have been found to avoid areas within 200 meters of the airstrip and road (Johnson et al.

2003a). Speed limits for vehicular traffic would help to minimize the effects of disturbance, particularly during brood-rearing when birds may be flightless.

Noise and visual stimuli associated with helicopter and fixed-wing air traffic would disturb waterfowl and loons near the proposed airstrip at the CD-3 site. The potential for aircraft to elicit reactions in waterfowl is well documented (Gollop et al. 1974a; Schweinsburg 1974; Ward and Stehn 1989; Derksen et al. 1992; McKechnie and Gladwin 1993; Johnson et al. 2003a). Responses of birds to aircraft include alert and concealment postures, interruption of foraging behavior, flight, and decreases in nest attendance (Johnson et al. 2003a). Nesting greater white-fronted geese took more and longer recesses from incubation as the number of airplanes increased and at nest sites closer to the airstrip (Johnson et al. 2003a). Of the various disturbance types, helicopters were the least predictable because they did not have a restricted flight pattern. Incubating greater white-fronted geese and tundra swans reacted more often to fixed-wing aircraft than to helicopters, although monitored nests were closer to the airstrip than to the helipad. Airplanes and pedestrians elicited the highest rates of response from incubating geese and vehicles the lowest. These behavioral responses to disturbances did not appear to affect nest outcomes (Johnson et al. 2003a). Greater white-fronted geese shifted nests from areas within 1 km of the airstrip at the Alpine Development to areas within 1 to 1.5 km during a period of heavy construction activity (Johnson et al. 2003a).

While some studies have suggested that helicopters may be more disturbing to wildlife than low-flying fixed-wing aircraft, others have indicated that both may elicit disturbance reactions (Gollop et al. 1974b; Johnson et al. 2003a). Waterfowl hazing may be necessary in the vicinity of the airstrip to reduce bird-aircraft collision hazards.

Disturbance effects during construction of the Alpine Development Project did not cause changes in nest site selection by tundra swans or yellow-billed loons (Johnson et al. 2003a). The distance of swan nests from the airstrip did not change from pre-construction to construction periods, and nesting success was not negatively affected by proximity of the airstrip. Two swan nests were incubated successfully within 500 meters of the airstrip during construction, and one of these remained 450 meters from the airstrip for at least 6 years, from pre-construction through the operational phase. Nesting yellow-billed loons also did not exhibit any measurable changes during construction of the Alpine Development, but only a few pairs nested in the area.

Other studies have also indicated the potential for noise-related disturbance to affect birds near the noise source. Anderson et al. (1992) reported that most waterfowl experienced no detrimental effects from noise near the Gas Handling Expansion Project at Prudhoe Bay, although pre-nesting Canada geese and nesting spectacled eiders appeared to use areas farther away from the facility noise. Gollop and Davis (1974) reported that feeding behavior of snow geese was adversely affected in the vicinity of an experimental gas compressor noise simulator and that some birds detoured around the experimental disturbance. Johnson et al. (2003a) reported that annual changes in greater white-fronted goose nest distribution reduced the average noise exposure at nest sites around the Alpine Development airstrip, but by a small and insignificant amount. Aircraft noise had inconsistent effects on incubation behavior and probably did not affect nesting outcome (Johnson et al. 2003a). Noise levels from helicopters and airplanes at CD-3 are likely to be less than at the Alpine airstrip because of fewer flights and use by twin-engine planes rather than the noisier four-engine planes used at Alpine (Johnson et al. 2003a).

Obstructions to Movement

In general, the infrastructure associated with Alternative A, including roads and production pads, the airstrip, buildings, elevated pipelines, power lines, bridges, and culverts, should not cause physical obstructions to most movements of waterfowl and loons. Usually, birds can easily fly over or around these structures. Birds would be most likely to collide with structures during periods of poor visibility such as foggy conditions or at dusk. These structures may present some temporary obstructions to movements of waterfowl and loons during brood-rearing and molting periods when birds are flightless, particularly if traffic levels are high (Murphy and

Anderson 1993). However, loons (Kertell 1994) and snow goose broods (Johnson 1998, 2000) have crossed roads in active oilfields, although they initially may have been impeded (Burgess and Ritchie, 1991).

Mortality

Some waterfowl and loon mortality would result from collisions with vehicles, elevated pipelines, buildings, or power lines, particularly under poor visibility conditions. Collisions with vehicles was the greatest source of bird mortality, primarily for ptarmigan and passerines, associated with the TAPS, particularly along the Dalton Highway where birds were attracted to roadside areas of early green-up caused by dust shadows (TAPS Owners 2001a). Mortality of a few individuals would be associated with collisions with aircraft during takeoff and landings. Mortality of a few individuals would be associated with birds that collide with structures such as elevated pipelines, buildings, power lines, or bridges. Some waterfowl and loons would also be expected to collide with power lines, although collisions would be infrequent (Murphy and Anderson 1993).

Some predators, such as ravens, gulls, arctic foxes, and bears, may be attracted to areas of human activity where they find human-created (anthropogenic) sources of food and denning or nesting sites (Larson 1960; Eberhardt et al. 1982; Day 1998; Burgess 2000). The availability of anthropogenic food sources, particularly during the winter, may increase winter survival of arctic foxes and contribute to increases in the arctic fox population. Anthropogenic sources of food at dumpsters and refuse sites may also help to increase populations of gulls and ravens above natural levels. Increased levels of depredation resulting from elevated numbers of predators could affect nesting and brood-rearing success for waterfowl and loons. Arctic foxes, glaucous gulls, and common ravens prey on eggs and young of waterfowl and loons (Murphy and Anderson 1993; Noel et al. 2002b; Rodrigues 2002; Johnson et al. 2003a). The numbers of foxes and most avian predators in the Alpine Development area did not appear to increase during construction of the project, with the exception of common ravens, which nested on buildings at the Alpine Development site (Johnson et al. 2003a). There was no indication that the presence of this pair of ravens caused an increased in nest depredation in the Alpine Development area (Johnson et al. 2003a). Addition of overhead power lines may increase mortality to waterfowl and loon nests by providing raptors and common ravens with perches that could enhance their ability to locate and depredate nests. In recent years, The North Slope Borough (NSB) has installed predator-proof dumpsters at camps and implemented refuse-handling techniques to minimize the attraction of predators to the landfill. Oilfield workers continually undergo training (and receive notifications from the CPAI Environmental group during the summer) to increase their awareness of the problems associated with feeding wildlife. These practices would mitigate the potential impacts related to increased levels of depredation and would be continued in the ongoing development of the ASDP.

Researchers conducting studies on bird nesting density and success may inadvertently attract predators to nests and broods (Bart 1977; Götmark 1992; Strang 1980). Birds that are flushed from their nests during surveys are more susceptible to nest depredation. Ongoing activities by researchers would cause some mortality to waterfowl and loon eggs and chicks. Mitigation plans that reduce human activity near nesting eiders were effective in reducing eider mortality during the nesting period (Johnson et al. 1987). Setbacks of 100 meters for people on foot was protective of waterbird nesting colonies for 8 of 10 species in Florida (Rodgers and Smith 1994).

Operation Period

Habitat Loss, Alteration, or Enhancement

Some habitat loss or alteration from snowdrifts, gravel spray, dust fallout, thermokarst, and ponding would continue during project operation. Dust fallout would be expected to be less than during the construction period because of reduced traffic. Habitat alterations may include changes in tundra vegetation from use of low-ground-pressure vehicles during summer or winter; these changes are unlikely to affect waterfowl and loons.

Disturbance and Displacement

Disturbance and displacement from aircraft and vehicle traffic and facility noise would be similar to during the construction phase. Disturbance would be reduced from the construction phase because of reduced levels of both air and ground traffic. Disturbance types, along with the general reactions of waterfowl and loons, were discussed under the Construction Period heading.

Boat traffic during oil spill drills, equipment checks, and boom deployment, especially airboat traffic, may be disruptive to pre-nesting, nesting, foraging, brood-rearing, and staging waterfowl and loons. Setbacks of 90 meters for motor boat traffic from nesting waterbird colonies in Florida were found to be protective (Rodgers and Smith 1994). Long-tailed ducks in Beaufort Sea lagoons did not show effects of disturbance by either seismic exploration or boat traffic on movement, habitat use, or foraging (Flint et al. 2003). Airboat traffic is most similar to low-flying aircraft (airboats are powered by aircraft engines), and waterfowl and loons may react in a manner similar to their reaction to aircraft traffic. These activities are expected to be of short duration and would at most cause temporary displacement of a few individuals.

Obstructions to Movement

Obstructions to movements from roadways would continue into the operation period and would be similar to the construction phase. Obstruction would be reduced from the construction phase because of reduced levels of traffic.

Mortality

Some waterfowl and loon mortality would result from collisions with aircraft, vehicles, elevated pipelines, buildings, power lines, or bridges, particularly under conditions of poor visibility. Collisions would be limited to a few individuals. Collision frequency would be expected to be less than during construction because of decreased traffic levels.

Ptarmigan

Ptarmigan nest in the areas proposed for development under Alternative A. Several ptarmigan nests were reported during ground searches for nesting birds near the area proposed for the airstrip and production pad in the CD-3 site (Johnson et al. 2003a). At the CD-4 site, ptarmigan nests were reported near the proposed site of the production pad and access road to CD-1 (Burgess et al. 2003a). At the CD-5 site, ptarmigan nested within about 500 meters of the access road south of the proposed pad (Burgess et al. 2003b). At the CD-6 site, a ptarmigan nested near the proposed site of the production pad. The closest ptarmigan nest to proposed infrastructure at the CD-7 site was several hundred meters north of the proposed access road. Gravel placement at the CD-3, CD-4, CD-5, and CD-6 sites could displace some nesting ptarmigan, although habitat is not limiting and birds would likely move to adjacent areas.

Construction Period

Habitat Loss, Alteration, or Enhancement

Winter placement of gravel during construction would account for most of the direct habitat lost or altered by Alternative A. Approximately 255 acres would be covered by gravel and lost as potential nesting, brood-rearing, and foraging habitat for ptarmigan. A total of one willow ptarmigan nest (based on nesting density in areas of proposed pad and road placement) would be affected by gravel placement.

Tundra adjacent to gravel fill would also be temporarily affected by snowdrifts, gravel spray, dust fallout, thermokarst, and ponding. Snowdrifts or plowed snow would cause a temporary loss of ptarmigan nesting and foraging habitat, while dustfall and early meltout near roads would provide foraging habitat during early spring. As with waterfowl, ptarmigan make use of forage in early green-up areas next to roadways created by dust deposition. Ptarmigan would use some structures, such as pipelines, for perches.

Ice roads and ice pads built during the winter would affect habitat for nesting ptarmigan if a delayed melting alters surface-water flow or reduces the availability of nesting habitat on tundra. This loss or alteration of habitat would be temporary.

Disturbance and Displacement

Few studies have been conducted to determine the effects of disturbances on nesting or brood-rearing ptarmigan. Ptarmigan sit very tightly during incubation, and disturbance by vehicular and air traffic, machinery, and facility noise would have little impact on nesting ptarmigan. Pedestrian traffic would also have little impact on nesting ptarmigan, because incubating females will continue to incubate even when humans are within a few feet of the nest. Some ptarmigan may remain on the Arctic Coastal Plain during winter, and a few birds would be disturbed or displaced during winter construction. Ptarmigan would be attracted to gravel fill sites because they provide grit and dust for bathing.

Obstructions to Movement

Movements of ptarmigan are unlikely to be affected by gravel placement for roads, well pads, and airstrips because ptarmigan can fly over or around such structures. Likewise, buildings, pipelines, and bridges should pose little obstruction to movements of ptarmigan.

Mortality

Ptarmigan could suffer mortality from collisions with vehicular traffic, machinery, buildings, bridges, and pipelines during the construction phase of the development. This is a likely cause of mortality for ptarmigan in the early spring when they are drawn to roadways by early green-up and access to grit. Ptarmigan were among the species of birds most often struck by traffic during the TAPS project, although the number of birds lost was likely low compared to area populations (TAPS Owners 2001a).

Operation Period

Habitat Loss, Alteration, or Enhancement

Some habitat loss or alteration from snowdrifts, gravel spray, dust fallout, thermokarst, and ponding would continue during project operation. Dust fallout would be expected to be less than during the construction period because of reduced traffic.

Disturbance and Displacement

Little disturbance or displacement of ptarmigan is expected, because this species appears to tolerate human activity. Potential disturbance would be lower during project operation than during construction because traffic levels would be reduced.

Obstructions to Movement

Obstruct the movements of ptarmigan would be similar to those during construction but would be reduced because of reduced traffic levels during project operation.

Mortality

Collisions with vehicles in the proposed development could cause a few ptarmigan deaths. Losses are most likely during spring when ptarmigan are attracted to areas of early green-up near roads and during the summer when more ptarmigan are likely to be present in the Plan Area. Reduced speed limits along roads, particularly during periods of poor visibility, may help to minimize the potential for collisions of ptarmigan with vehicles. The potential for mortality of ptarmigan from collisions with elevated pipelines, bridges, power lines, and buildings would be limited to a small number of individuals.

Increased numbers of arctic foxes, common ravens, and glaucous gulls attracted to developed areas would increase mortality of adult ptarmigan, eggs, and chicks. Proper handling of garbage and educating oilfield workers about the problems associated with feeding wildlife have mitigated these effects at the Alpine Development.

Raptors and Owls

Raptors and owls are generally uncommon visitors and occasional nesters in the Plan Area. Potential nesting species on the Arctic Coastal Plain include peregrine falcon, rough-legged hawk, northern harrier, short-eared owl, and snowy owl. In the Plan Area, a peregrine falcon nest was reported on a bank of Fish Creek approximately 3.5 miles from the CD-7 site (Burgess et al. 2003b). Northern harrier and short-eared-owl nests have been found at CD-4 (Burgess et al. 2003a). These species and other raptors that occur in the area are occasionally observed foraging and passing through during migration. Juvenile golden eagles use the Arctic Coastal Plain for foraging and are often observed during the caribou calving period. Golden eagles do not nest in the Plan Area.

Construction Period

Habitat Loss, Alteration, or Enhancement

Habitat loss and disturbance resulting from winter gravel placement for the proposed development is unlikely to affect the few raptors and owls occurring in the Plan Area. Snowdrifts or plowed snow would cause a temporary loss of nesting habitat for northern harriers, short-eared owls, and snowy owls. Short eared owls, snowy owls, and northern harriers are attracted by aggregations of waterfowl and ptarmigan in green-up areas created by dustfall and early meltout near roads.

Towers, pipelines, and power lines would provide perches, which would improve foraging efficiency, and would provide potential nesting habitat for raptors. Although rough-legged hawks and peregrine falcons use abandoned infrastructure for nesting, it is unlikely that they would nest in active oilfield areas. There have been no reported nests in the Prudhoe Bay oilfield area.

Disturbance and Displacement

The small numbers of raptors and owls present in the Plan Area are not likely to be disturbed by the proposed development.

Obstructions to Movement

Gravel roads, buildings, pipelines, power lines, and bridges are unlikely to obstruct movements of raptors.

Mortality

It is unlikely that the small number of birds that occur in the Plan Area would suffer any mortality from collisions with vehicular traffic, air traffic, buildings, bridges, or pipelines.

Operation Period

Habitat Loss, Alteration, or Enhancement

Some habitat alteration from dust fallout would continue during project operation and would continue to attract raptors to aggregations of waterfowl and ptarmigan next to the roadways. Towers, pipelines, and power lines would continue to provide perches, which would improve foraging efficiency for raptors.

Disturbance and Displacement

The small numbers of raptors and owls present in the Plan Area would not be likely to be disturbed by the proposed development. Airboat-based oil-spill drills, equipment checks, and boom placement along river channels may disturb raptors or disrupt their foraging. Nesting occurs along riverbanks south of the proposed development. Any boat-based traffic in these nesting areas may disturb nesting raptors.

Obstructions to Movement

Gravel roads, buildings, pipelines, power lines, and bridges are unlikely to obstruct raptor movements.

Mortality

It is unlikely that the small number of birds that occur in the Plan Area would suffer any mortality from collisions with vehicular traffic, air traffic, buildings, bridges, or pipelines.

Shorebirds

The following shorebird species may be most affected by the proposed developments in Alternative A, based on abundance and occurrence (Burgess et al. 2003b; Johnson et al. 2003a):

CD-3 and CD-4 – pectoral sandpiper, semipalmated sandpiper, red-necked phalarope, red phalarope

CD-5 – pectoral sandpiper, semipalmated sandpiper, long-billed dowitcher, red-necked phalarope, stilt sandpiper

CD-6 – pectoral sandpiper, semipalmated sandpiper, red-necked phalarope, long-billed dowitcher, buff-breasted sandpiper

CD-7 – pectoral sandpiper, semipalmated sandpiper, red-necked phalarope, long-billed dowitcher, buff-breasted sandpiper

Construction Period

Habitat Loss, Alteration, or Enhancement

Under Alternative A, winter placement of gravel during construction would account for most of the direct habitat lost or altered. Approximately 270 acres would be covered by gravel and lost as potential nesting, brood-rearing, foraging and staging habitat for shorebirds during the construction of the project. Habitat losses from gravel fill would be long-term. A total of 66 shorebird nests (based on nesting densities found in the areas of proposed pad and road placement), including 21 pectoral sandpiper and 14 semipalmated sandpiper nests, would be affected by gravel placement. Habitats important to nesting and brood-rearing seabirds that would be affected by gravel placement in the Colville River Delta include Aquatic Sedge with Deep Polygons (0.2 percent of available habitat altered), Nonpatterned Wet Meadow (0.3 percent of habitat altered), and Patterned Wet Meadow (0.2 percent of habitat altered). Habitats important to nesting and brood-rearing seabirds that would be affected by gravel placement in the NPR-A area include Aquatic Sedge Marsh (0.1 percent of available habitat altered) and Old Basin Wetland Complex (0.1 percent of habitat altered).

Dust shadows leading to early snowmelt and green-up may also increase nesting and foraging habitat availability for shorebirds. Construction of gravel roads may result in alteration of habitat by the development of ponds and thermokarsting of soils at the edges of roads and pads. For species such as dunlin, plovers, and buff-breasted sandpipers that prefer drier habitat types (Derksen et al. 1981; Schoen and Senner 2002; Lanctot and Laredo 1994), these impacts would result in a small amount of habitat loss. For species such as pectoral sandpipers and phalaropes (Schoen and Senner 2002; Derksen et al. 1981) that prefer to nest and rear young near water, these alterations would result in a small increase in habitat. Alterations in habitats near roads, including interruption of surface flow and thermokarst, create very wet and emergent tundra that is preferred by red-necked phalaropes (Rodrigues 1992; Noel et al. 1996).

Ice roads and ice pads built during the winter to support construction activities would also affect habitat for nesting shorebirds if a delayed melt reduces the availability of nesting habitat on the tundra. Shorebirds should be into incubation before the ice roads melt and would be displaced to other areas. Water withdrawal for construction of ice roads would not affect nesting shorebirds. Habitat alterations may include changes in tundra vegetation from use of low-ground-pressure vehicles during summer or winter; these changes may decrease habitat quality for nesting shorebirds by compression of tussocks and standing dead vegetation.

Removal of gravel from the ASRC and Clover gravel sites would result in a temporary loss of habitat while the mine sites are active and an alteration in habitat types when the gravel sites are reclaimed. The alteration of habitats could be detrimental to some shorebird species but beneficial to others.

Disturbance and Displacement

Winter construction activities would not disturb or displace shorebirds. Increased human activity along roads (primarily vehicles), at production pads (vehicles and pedestrians), and at the CD-3 airstrip (fixed-wing aircraft, vehicles, and pedestrians) to facilitate construction of infrastructure at the production pads during the summer would potentially disturb or displace some shorebirds.

Construction activities on the production pads, vehicle traffic along the roads, and aircraft activities at CD-3 would result in localized high noise levels. (Johnson et al. 2003a) did not find that nesting shorebirds moved farther from the Alpine Development during summer construction activities. Semipalmated sandpipers nested significantly more frequently in areas closer to the Alpine airstrip than in areas farther from the airstrip, but annual variability in nest locations was high. Pectoral sandpipers and red-necked phalaropes nested slightly more often near the airstrip than away from it. Other North Slope studies designed to assess the impacts of disturbance from oil and gas activities on nesting birds have reported mixed results. In the Prudhoe Bay field, Troy (1988) found that nesting semipalmated sandpipers and dunlin were less common adjacent to spine roads than away from roads, but there was little difference in numbers of these species near less-trafficked access roads and roadless areas. In the same study, red-necked phalaropes were more common near roads than away from roads.

Because of the proximity of CD-3 to the salt marshes and coastal silt barrens of the Colville River Delta and the proposed flight patterns of fixed-wing aircraft planned at CD-3, shorebirds gathering in coastal areas of the Colville River Delta to build fat reserves for migration (Andres 1994) may be displaced from feeding areas near CD-3 in response to increased human activities and noise levels during construction. Primary species included in post-breeding foraging flocks of shorebirds include dunlin, semipalmated sandpipers, red-necked phalaropes, western sandpipers, and pectoral sandpipers (Andres 1994). Displacement of large flocks of shorebirds from these important and limited habitats could adversely affect the migrant shorebird population passing through the Delta (Andres 1994).

Obstructions to Movements

The construction of gravel roads and pads is not anticipated to obstruct shorebird movements because most birds can fly. However, shorebird broods attempting to move from nesting sites to brood-rearing areas may be obstructed by the presence of roads and pads and traffic volumes associated with construction activities.

Mortality

A few individual shorebirds may die if they fly into infrastructure on production pads, pipelines, or power lines or if they collide with vehicles or aircraft as they fly or walk (with broods) across roads, pads, or airstrips. Potential mortality from vehicles may be mitigated by slower speed limits on roads during brood-rearing periods. Addition of overhead power lines between CD-6 and CD-7 may increase mortality to shorebirds and their nests by providing raptors and common ravens with perches that could enhance their ability to locate and depredate incubating individuals and nests. Shorebirds may also collide with power lines. More than 15 red phalaropes collided with power lines in Barrow during a 2-day period in fall 2003 (R. Suydam, NSB, pers. comm.)

Operation Period

Habitat Loss, Alteration, or Enhancement

Some habitat loss or alteration from snowdrifts, gravel spray, dust fallout, thermokarst, and ponding would continue during project operation. Dust fallout would be expected to be less than during the construction period because of reduced traffic. Nesting habitat would be lost to shorebirds during the operation period as a result of annual ice road construction. Impacts from ice road construction would be similar to those discussed for the construction period. However, if ice roads are placed in the same location annually, impacts to the tundra could be longer-term.

Habitat alterations during the operation period may include changes in tundra vegetation from use of low-ground-pressure vehicles during summer or winter. Impacts from habitat alterations during operations would be similar to those on other bird species. Phalaropes have been reported nesting in association with thermokarst

Disturbance and Displacement

Disturbance and displacement of shorebirds during operation activities would be similar to that during construction activities except that most human activities and noise levels would be lower during operations. In addition, oil-spill drills and boom placement will cause additional disturbance along the river channels and in the Delta. Noise from airboat traffic would temporarily displace shorebirds.

Obstructions to Movements

Obstructions to movements would be the similar to that during the construction phase, although lower traffic levels may reduce obstruction.

Mortality

Direct mortality of a few individual shorebirds would occur during operational activities from collisions with structures or vehicles. However, if oil and gas activities were to result in an increase in predator species such as foxes, ravens, gulls, and jaegers in the area, nest depredation of shorebirds may increase. Strict waste-handling procedures in place at North Slope oil facilities likely would limit increases in predator populations.

Seabirds (Gulls, Jaegers, and Terns)

The following seabirds may be may be most affected by the proposed developments in Alternative A based on abundance and occurrence (Burgess et al. 2003b; Johnson et al. 2003b):

CD-3—Sabine's gull, arctic tern, glaucous gull, long-tailed jaeger

CD-4—arctic tern, long-tailed jaeger

CD-5—glaucous gull, arctic tern, long-tailed jaeger

CD-6—no seabirds recorded

CD-7—Sabine's gull, arctic tern, glaucous gull, parasitic jaeger

Construction Period

Habitat Loss, Alteration, and Enhancement

Winter placement of gravel during construction would account for most of the direct habitat lost or altered by Alternative A. Approximately 255 acres would be covered by gravel and lost as potential nesting, brood-rearing, and foraging habitat for seabirds, primarily gulls, jaegers, and arctic tern. Habitat losses from gravel fill would be long-term. A total of one seabird nest (based on nesting densities found in the areas of proposed pad and road placement) would be affected by gravel placement. Habitats important to seabirds that would be covered by gravel include Aquatic Sedge with Deep Polygons, and Patterned and Non-Patterned Wet Meadows.

Loss of seabird habitat under Alternative A would be similar to that described above for waterfowl and loons. Use of areas near gravel roads, pads, and airstrips by seabirds is less well documented than for waterfowl and loons, and some of the effects of habitat alterations associated with gravel placement, such as snowdrifts, dust fallout, thermokarst, and ponding, may be less likely to affect seabirds than waterfowl. Ponded areas would be attractive to seabirds, particularly glaucous and Sabine's gulls and arctic terns, that nest on islands or along shorelines of lakes and other wetlands.

Disturbance and Displacement

Disturbance and displacement related to Alternative A would likely displace some nesting seabirds near the proposed airstrip at CD-3. Although disturbances may displace some seabirds from nesting, brood-rearing, or foraging habitats, the birds would likely move to adjacent habitats if suitable habitats are available.

Seabirds may be particularly responsive to pedestrian traffic. Incubating glaucous gulls, Sabine's gulls, arctic terns, and jaegers leave the nest with the approach of humans on foot in the same manner as for approaching mammalian or avian predators (Rodgers and Smith 1994). These species use mobbing activity to try to discourage such intrusion by humans or predators. Incubation recesses caused by pedestrian traffic would make seabird nests more susceptible to depredation (Noel et al. 2002b).

Glaucous gulls could be attracted to gravel structures and associated facilities and human activity because of the potential availability of anthropogenic sources of food. Glaucous gulls could nest in the project area and could forage at the landfill in Nuiqsut. Glaucous gulls could key into human-related disturbances to nesting waterfowl that leave nests unattended, allowing gulls to feed on the eggs (Noel et al. 2002b). This attraction can be minimized by implementing and monitoring the proper handling of refuse in approved dumpsters and by providing workers with training on the problems associated with feeding wildlife.

Obstructions to Movement

Most movements by seabirds are not likely to be obstructed during construction of the proposed development under Alternative A. Brood-rearing seabirds may have difficulty crossing roadways and gravel airstrips.

Mortality

A few seabirds could die from collisions with vehicles along roadways. Glaucous gulls, in particular, would occasionally struck by vehicles along roadways. Seabirds, especially gulls, are also particularly vulnerable to collisions with aircraft, and a few gulls would be expected to collide with aircraft. Mortality from collisions with buildings, pipelines, power lines, or communication towers is also possible; however, that is expected to be limited to a few individuals. The potential for increased levels of depredation to affect seabird egg and chick mortality may be lower than that described for waterfowl, because seabirds at nest sites and with broods are generally aggressive toward predators. Seabird mobbing behaviors would reduce mortality by deterring predators.

Operation Period

Habitat Loss, Alteration, and Enhancement

Some habitat loss or alteration from snowdrifts, gravel spray, dust fallout, thermokarst, and ponding would continue during project operation. Dust fallout would be expected to be less than during project construction because of reduced traffic.

Disturbance and Displacement

Disturbance and displacement from aircraft, vehicle and pedestrian traffic, and facility noise would be similar to that during project construction. Disturbance would be reduced because of reduced levels of both air and ground traffic. Seabirds may be either disturbed and displaced by or attracted to airboat-based spill drill, equipment check, and boom placement activities.

Obstructions to Movement

Most seabird movements would not be obstructed by the proposed development. Structures may present some temporary obstructions to movements of seabirds during brood-rearing, particularly if traffic levels are high.

Mortality

Some seabird mortality, limited to a few individuals, may be related to development under Alternative A. Glaucous gulls, in particular, would occasionally be struck by vehicles along roadways. Traffic levels are expected to be less during project operation than during construction, which would reduce potential mortality to seabirds from collisions. Seabirds, especially gulls, are also particularly vulnerable to collisions with aircraft and a few gulls would be expected to collide with aircraft. Mortality from collisions with buildings, pipelines, power lines, or communication towers are also possible; however these are expected to be limited to a few individuals. The potential for increased levels of depredation to affect seabird egg and chick mortality may be lower than that described for waterfowl, because seabirds at nest sites and with broods are generally aggressive toward predators. Seabird mobbing behaviors would reduce mortality by deterring predators. Biologists may cause additional mortality during intensive nest search activities (Noel et al. 2002b).

Passerines

The following passerine species may be may be most affected by the proposed developments in Alternative A, based on abundance and occurrence (Burgess et al. 2003b; Johnson et al. 2003a):

CD-3 and CD-4 – Lapland longspur, Savannah sparrow, yellow wagtail, common redpoll, common raven

CD-5 – Lapland longspur, common raven

CD-6 – Lapland longspur, Savannah sparrow, common redpoll, yellow wagtail

CD-7 – Lapland longspur, Savannah sparrow, common redpoll

Construction Period

Habitat Loss, Alteration, or Enhancement

Winter placement of gravel during construction would account for most of the direct habitat lost or altered by Alternative A. Approximately 255 acres would be covered by gravel and lost as potential nesting and foraging habitat for passerines. Habitat losses from gravel fill would be long-term. A total of 32 passerine nests (based on nesting densities found in the areas of proposed pad and road placement), primarily Lapland longspur nests, would be affected by gravel placement. Habitats important to passerines that would be affected by gravel in the Plan Area include Moist Sedge-Shrub Meadow (0.6 percent of habitat in the Colville River Delta altered; 0.2 percent of habitat in the NPR-A altered), Moist Tussock Tundra (0 percent altered in the Colville River Delta; 0.4 percent altered in the NPR-A), Riparian Low and Tall Shrub (less than 0.1 percent altered in the NPR-A), and Riverine or Upland Shrub (0.1 percent altered in the Colville River Delta).

Development of ponds and thermokarsting of soils caused by gravel placement would negatively alter habitat for passerine species. This habitat alteration would be slightly more lost habitat than that resulting from placement of gravel fill.

The construction of ice roads to facilitate gravel road, pad, and pipeline construction would result in a temporary loss of nesting habitat because ice roads would melt later than surrounding areas, and passerines likely would be well into incubation before the ice roads melted. Construction of ice roads also may temporarily disturb underlying vegetation and soils, reducing habitat quality for one or two additional nesting seasons. Of particular importance to passerines that prefer willow and other tall shrub habitat would be stream crossings where tall shrubs may be damaged by compacted ice (McKendrick 2000a).

Removal of gravel from the ASRC and Clover mine sites would result in a temporary loss of habitat while the mine sites are active and an alteration in habitat type when the gravel sites are reclaimed. Depending on nesting habitat preferences of passerine species, this alteration of habitat may provide more or less potential nesting habitat than before gravel removal.

Addition of structures such as towers, buildings, and VSMs for pipeline support would add nesting habitat for common ravens and snow buntings.

Disturbance and Displacement

Winter construction activities would not disturb or displace most passerines. Common ravens are the only resident passerine species on the North Slope. They may be attracted to construction activities by access to human food, shelter from wind, and access to warm air vents.

During the spring and summer, increased human activity along roads (primarily vehicles), at production pads (vehicles and pedestrians), and at the CD-3 airstrip (fixed-wing aircraft, vehicles, and pedestrians) to facilitate summer construction of pad infrastructure may disturb or displace some passerines, primarily Lapland longspurs, which are the most abundant nesters.

Passerine nests were not displaced from the area around an airstrip at the Alpine Development (Johnson et al. 2003a). Lapland longspurs nested in higher densities near an active airstrip at Alpine than they did away from the airstrip, although the trend was not significant. Other passerines nested in densities too low to evaluate (Johnson et al. 2003a). See other species group descriptions for a discussion of the range of responses to aircraft noise.

Obstructions to Movements

The construction of gravel roads and pads is not anticipated to obstruct movements of passerines because birds can fly and brood-rearing passerines raise their young in the nest until they are capable of flight.

Mortality

A few individual passerines may die if they fly into production pads, pipelines, buildings, or power lines or if they collide with vehicles as they fly across roads. Towers and building may provide nest sites and perching habitat for common ravens, which may increase nest depredation among tundra-nesting passerines (Johnson et al. 2003a; Murphy and Anderson 1993). Construction of oil development facilities also may result in an increase in other predator species such as foxes, gulls, and jaegers. The impacts of nest depredation on passerines would likely be low because of the difficulty predators would have in locating most passerine nests.

Operation Period

Habitat Loss, Alteration, or Enhancement

Some habitat loss or alteration from snowdrifts, gravel spray, dust fallout, thermokarst, and ponding would continue during project operation. Dust fallout would be expected to be less than during the construction period because of reduced traffic. Impacts from ice road construction would be similar to those discussed for construction. However, if ice roads are placed in the same location annually, impacts to the tundra and tall shrubs could be longer-term. Habitat alterations during the operation period may include changes in tundra vegetation from use of low-ground-pressure vehicles during summer or winter. Impacts from habitat alterations during operations would be similar to those on other bird species.

Addition of towers, buildings, and pipelines would enhance nesting habitat for common ravens and snow buntings. Long-term storage of oilfield equipment provides nesting habitat for snow buntings in the Prudhoe Bay oilfield, and construction of new facilities on production pads provides nesting habitat for common ravens.

Disturbance and Displacement

Disturbance and displacement of passerines during operational activities would probably have little to no impact on passerines. These activities did not appear to disrupt nesting at the Alpine Development during construction, and levels of most human activities are expected to be lower during operations (Johnson et al. 2003a).

Obstructions to Movements

Obstructions to movements would be the same during the operations phase as during the construction phase.

Mortality

Direct mortality of a few passerines would occur during operational activities as a result of collisions with infrastructure or vehicles. A potential increase in common ravens or other predators as a result of oilfield infrastructure could result in low-level increases of passerine mortality during nesting. Researchers may cause nest success to decrease by disturbance of nesting birds thereby increasing depredation.

4A.3.3.2 Alternative A – Full-Field Development Plan Impacts on Birds

Under the FFD scenario for Alternative A, the mechanisms associated with impacts related to habitat loss and alteration, disturbance and displacement, obstruction to movements, and mortality for birds in the three facility group areas would be the same as those described under Alternative A for the ASDP. Under Alternative A of the FFD, roads would link all production pads, except for four pads in the lower Colville River Delta and the CD-29 pad in the Kalikpik-Kogru Rivers Facility Group, to processing facilities and to the existing Alpine Development facilities. Airstrips would be constructed at the production pads in the lower Colville River Delta and at CD-29 in the Kalikpik-Kogru Rivers Facility Group for maintenance and operational support. Hypothetical development summarized by three facility groups, Colville River Delta, Fish-Judy Creeks, and Kalikpik-Kogru Rivers, would be in addition to the development proposed under Alternative A of the ASDP, and the potential impacts described below would be in addition to those described under Alternative A for the ASDP. The effects of FFD on species within the various bird groupings would depend on the location and extent of development in specific locations within each area. Potential impacts might be less well understood for some portions of the ASDP area because less intense study has occurred.

Colville River Delta Facility Group

No roads are hypothesized in this part of the Plan Area. Pipelines would be constructed over several major watercourses including the Elaktoveach Channel, Kupigruak Channel, Tamayayak Channel, and the main stem of the Colville River. In-stream construction activities at these water bodies would have the potential to cause impacts as described in 4A.3.3.1.

A summary of the potential numbers of bird nests affected by the hypothetical FFD in the Colville River Delta Facility Group based on nesting densities reported for the Colville River Delta are presented in Table 4A.3.3-4.

Habitat Loss, Alteration, or Enhancement

In addition to habitat loss described under Alternative A for the ASDP, there would be additional habitat loss in the Colville River Delta for airstrips associated with the CD-14, CD-19, CD-20, and CD-21 sites. Gravel roads would connect CD-11, CD12, and CD-15 to the Alpine Development.

Waterfowl and Loons

Extensive nesting and brood-rearing surveys have been conducted in the Colville River Delta for loons and some waterfowl species (Johnson et al. 1999; Burgess et al. 2003a; Johnson et al. 2003a). Brood-rearing white-fronted geese have been reported in the vicinity of the CD-11, CD-12, CD-14, and CD-20 sites (Johnson et al. 2003b). A small brant colony and broods have been reported near the proposed CD-20 site, and the large Anachlik brant colony is near the CD-21 site (Johnson et al. 2003b). Fall-staging brant have been reported at the CD-14, CD-18, CD-20, and CD-21 sites (Johnson et al. 2003b). Tundra swan nests and broods are distributed throughout the Colville River Delta and have been reported in the vicinity of all the proposed FFD pads except CD-21 (Johnson et al. 2003b). These studies indicate that nesting yellow-billed loons could be affected by habitat loss and alteration at the CD-11, CD-12, CD-14, and CD-15 sites, and broods were reported near the CD-11 and CD-14 sites (Johnson et al. 2003b). Pacific loon nests and broods have also been reported in the general area of these proposed production pads as well as at the CD-20 site (Johnson et al. 2003b). During pre-nesting surveys, king eiders were recorded at numerous locations in the Colville River Delta including the proposed sites at CD-20 and CD-21, although king eiders were much more abundant in the transportation corridor between the Delta and the Kuparuk oilfield (Johnson et al. 2003b).

TABLE 4A.3.3-4 SUMMARY OF ALTERNATIVE A FFD IMPACTS TO NESTING BIRDS

Bird Group	Gravel	Dust	Ice Roads	Airstrips[a,b]	Total
Colville River Delta Facility Group					
Waterfowl	6	1	2	25	34
Loons	1	0	0	4	5
Ptarmigan	1	0	0	3	4
Raptors and Owls	0	0	0	0	0
Seabirds	1	0	0	3	4
Shorebirds[c]	85	13	37	0	135
Passerines[c]	42	7	18	0	67
Total Birds	**136**	**21**	**57**	**35**	**249**
Fish-Judy Creeks Facility Group					
Waterfowl	17	9	2	0	28
Loons	2	1	0	0	3
Ptarmigan	2	1	0	0	3
Raptors and Owls	0	0	0	0	0
Seabirds	3	1	0	0	4
Shorebirds[c]	119	60	11	0	190
Passerines[c]	62	31	6	0	99
Total Birds	**205**	**103**	**19**	**0**	**327**
Kalikpik-Kogru Rivers Facility Group					
Waterfowl	10	4	3	8	25
Loons	1	1	0	1	3
Ptarmigan	1	0	0	1	2
Raptors and Owls	0	0	0	0	0
Seabirds	2	1	1	1	5
Shorebirds[c]	68	28	22	0	118
Passerines[c]	35	15	11	0	61
Total Birds	**117**	**49**	**37**	**11**	**214**

Notes:

[a] Disturbance at airstrips would potentially reduce nesting by 50% within 500 meters of airstrip (Johnson et al. 2003a).

[b] No airstrip is proposed in the Fish-Judy Creeks Facility Group for Alternative A FFD.

[c] No disturbance effects from airstrips have been shown for these groups (Johnson et al. 2003a).

Distribution information for gulls was available for four of the seven areas proposed for hypothetical FFD. Glaucous gulls used areas adjacent to CD-15, CD-11, CD-14 for nesting and brood-rearing, but did not use areas near CD-12 (Johnson et al. 2003b; Burgess et al. 2003a).

Ptarmigan, raptors and owls, seabirds, shorebirds, and passerines are expected to occur throughout the development area in numbers and distributions similar to the survey area covered for CPAI Development Plan alternatives in the Colville River Delta (Burgess et al. 2003a; Johnson et al. 2003a, 2003b). Densities for these species generated from intensive surveys were used to calculate the numbers of nests potentially affected by gravel placement. These bird groups use habitats in the Colville River Delta for brood-rearing, foraging, and migration staging.

Disturbance and Displacement

Under Alternative A FFD in the Colville River Delta, aircraft traffic and noise would likely be a source of disturbance to birds, although disturbance related to vehicular traffic and machinery could also affect birds along the access roads to CD-11 and CD-12 and along the access roads from production pads to airstrips. The road from Nuiqsut could increase the potential for local traffic to affect birds along the access roads to the CD-2, CD-4, CD-11, CD-12, and CD-15 sites. The types of disturbances would be the same as those described above under Alternative A for the ASDP sites.

Waterfowl and Loons

The density of nesting birds would potentially be reduced as a result of disturbance from the four additional airstrips in the lower Colville River Delta (Johnson et al. 2003a). Brood-rearing and staging waterfowl and loons in the lower Colville River Delta would also be disturbed and potentially displaced from the lower Delta by air traffic. Nesting and brood-rearing waterfowl and loons occurring near the airstrips may need to be hazed from airstrips, increasing disturbance.

The few ptarmigan that nest in the lower Colville River Delta are not likely to be disturbed by the four additional airstrips. The few raptors and owls that nest in the Colville River Delta are not likely to be disturbed by the four additional airstrips in the lower Colville River Delta during nesting. A few foraging raptors may be disturbed or displaced by air traffic in the lower Colville River Delta when they concentrate to forage on staging shorebirds. Nesting, brood-rearing, and staging seabirds would be disturbed by the four additional airstrips in the lower Colville River Delta. The lower Colville River Delta is an important feeding area for post-breeding shorebirds. Foraging flocks of shorebirds would be disturbed and displaced from tidal habitats used in the lower Delta. Nesting and foraging passerines would be disturbed by air and vehicle traffic and potentially displaced from adjacent habitats used in the Colville River Delta.

Obstructions to Movements

Under the FFD scenario for Alternative A in the Colville River Delta Facility Group, there would be little increase in the potential for the proposed development to obstruct bird movements. Most of the proposed sites are roadless, and there is little evidence that pipelines may present more than occasional, temporary obstruction to bird movements. Access roads would be constructed for the CD-11, CD-12, and CD-15 sites, and brood-rearing waterfowl and loons may have some difficulty crossing these roads, especially during the construction period. Speed limits for vehicular traffic and machinery, especially during brood-rearing periods, may help to mitigate the potential for roads to obstruct bird movements.

Mortality

Mortality of waterfowl and loons, ptarmigan, seabirds, shorebirds, and passerines would result from collisions with vehicular traffic, buildings, pipelines, and bridges. Under Alternative A FFD, traffic levels in the Colville River Delta would be minimal because of the roadless condition of most of the project. However, mortality from collisions with aircraft would be increased for all bird groups by the four airstrips in the outer Colville River Delta. Seabirds, especially gulls, are particularly vulnerable to collisions with aircraft. Mortality-causing impacts from aircraft collisions could be mitigated by hazing of waterfowl and seabirds away from active airstrips.

Increased depredation from predators attracted to the proposed development could increase mortality of tundra-nesting adult birds, eggs, and chicks. In particular, seabirds, especially glaucous gulls, are likely to be attracted to the area. Road access from Nuiqsut may allow for increased subsistence hunting pressure on waterfowl and increased bird mortality near the CD-2, CD-4, and hypothetical CD-11, CD-12, and CD-15 sites.

Fish-Judy Creeks Facility Group

A summary of potential effects to bird groups by the hypothetical FFD in the Fish-Judy Creeks Facility Group is presented in Table 4A.3.3-4.

Habitat Loss and Alteration

Nesting, brood-rearing, and staging waterfowl and loons would be affected by habitat loss resulting from gravel placement. The following species have been recorded at hypothetical pad and production facilities in the Fish-Judy Creeks Facility Group (Burgess et al. 2003b; Noel et al. 2002c):

CD-8: greater white-fronted goose, Canada goose, tundra swan, Pacific loon, yellow-billed loon

CD-9: greater white-fronted goose, Canada goose, Pacific loon, yellow-billed loon

CD-10: greater white-fronted goose, Canada goose, snow goose, black brant, Pacific loon

CD-13: Canada goose, black brant, tundra swan, Pacific loon

CD-22: greater white-fronted goose, black brant, Pacific loon

CD-23: tundra swan, Pacific loon, yellow-billed loon

CD-24: tundra swan, Pacific loon

APF-2: greater white-fronted goose, tundra swan, yellow-billed loon.

Ptarmigan, raptors and owls, seabirds, shorebirds, and passerines are expected to occur throughout the development area in numbers and habitats similar to the survey area covered for the CPAI Development Plan alternatives in the NPR-A (Burgess et al. 2003b). Densities of these species generated from intensive surveys were used to calculate the numbers of nests potentially affected by gravel placement (Table 4A.3.3-4).

Disturbance and Displacement

Under Alternative A FFD in the Fish-Judy Creeks Facility Group, vehicular traffic and other activities associated with the road system would be the greatest source of disturbance. In addition, noise associated with hypothetical processing facility APF-2 could also affect birds. The mechanisms of impacts would be the same as those described above under Alternative A for the ASDP sites.

Traffic along the road that runs parallel to and crosses Judy Creek in two places would disturb female buff-breasted sandpipers that use stream corridors for migration, rest breaks during nesting, and brood rearing. Buff-breasted sandpipers were recorded on plots northeast of the proposed APF-2 location (Burgess et al. 2003a). The proposed development would affect small amounts of habitats potentially used by this species.

Obstructions to Movements

Under Alternative A for FFD in the Fish-Judy Creeks Facility Group, potential obstruction to bird movements could occur along the road system, particularly if traffic levels are high. Traffic levels are primarily the result of industry use and could increase if the roads are open to local traffic. In general, roads do not present obstructions to bird movements. High traffic levels or high speeds on roads could pose some obstruction to bird movements if birds were displaced by disturbance. Speed limits for vehicular traffic and machinery, especially during brood-rearing periods, may help to minimize potential for roads to obstruct bird movements.

Mortality

Other than mortality related to an oil spill, there would likely be little mortality related to the development under Alternative A FFD. Mortality of a few individual birds would result from collisions with vehicles. The potential for bird mortality associated with vehicular collisions under Alternative A FFD would be increased by the addition of 75 miles of road system. The level of mortality would probably be limited to a few individuals every year. Speed limits along roads, particularly during periods of poor visibility and during brood-rearing, may help to reduce the potential for collisions of birds with vehicles.

Some mortality to a few individuals would result from collisions with structures such as elevated pipelines, production modules, or bridges. The potential for bird mortality to result from collisions with structures under Alternative A FFD would be increased by the addition of 80 miles of pipelines.

Road access from Nuiqsut may increase the potential for subsistence hunting to affect birds along the entire road system for the Fish-Judy Creeks Facility Group. The potential for increased levels of depredation to affect tundra-bird nest success may increase under Alternative A FFD because of the increase in the amount of infrastructure. Studies at the Alpine Development have not indicated that predators have increased in response to the development (Johnson et al. 2003a). In recent years, oilfield operators have placed garbage that could attract predators into predator-proof dumpsters, and oilfield workers have been educated about the problems associated with feeding wildlife. Continuation of these practices in the FFD may help to minimize potential impacts to tundra-nesting birds.

There is evidence that researchers conducting studies on avian nest density and success may inadvertently affect the results by attracting predators to nests and broods (Bart 1977; Götmark 1992). Birds that are flushed from their nests during surveys may be more susceptible to nest predation than undisturbed birds. Ongoing activities by researchers could cause some mortality to eggs and chicks of tundra-nesting birds. Increased aerial survey efforts from agency- and industry-sponsored studies to support development within the NPR-A may cause additional flushing and disturbance of pre-nesting waterfowl.

Kalikpik-Kogru Rivers Facility Group

A summary of potential impacts to birds groups by the hypothetical FFD in the area of the Kalikpik-Kogru rivers is presented in Table 4A.3.3-4.

Habitat Loss, Alteration, or Enhancement

Habitat loss and alteration could occur in addition to that identified for the CPAI Development Plan Alternative A in the Kalikpik-Kogru Rivers Facility Group as a result of gravel placement for four well pads, a processing facility, one airstrip, and 40 miles of gravel access roads (Table 4A.3.3-4). Waterfowl and loon concentrations are expected to be similar to those in other areas surveyed for waterfowl in the NPR-A (Johnson et al. 2003b; Noel et al. 2002c).

Disturbance and Displacement

Under Alternative A FFD for in the Kalikpik-Kogru Rivers Facility Group, vehicular traffic and other activities associated with the road system would be a source of disturbance to birds. Road access from Nuiqsut may increase the potential for local traffic to disturb birds along the entire road system of the Kalikpik-Kogru Rivers Facility Group. In addition, noise associated the hypothetical APF-3 and air traffic at the CD-29 airstrip would disturb birds. The types of impacts would be the same as those described above for the CPAI Development Plan sites.

Obstructions to Movements

Under Alternative A FFD for in the Kalikpik-Kogru Rivers Facility Group, potential obstruction to bird movements would be increased by the addition of the road system, particularly if traffic levels are high. Traffic levels are primarily the result of industry use and would increase if the roads were open to local traffic. In general, roads do not present obstructions to bird movements. However, high traffic levels or high speeds on roads could pose some obstruction to bird movements. Speed limits for vehicular traffic and machinery, especially during brood-rearing periods, could help minimize the potential for roads to obstruct bird movements.

Mortality

The potential of the Alternative A FFD to affect mortality of tundra-nesting birds in the Kalikpik-Kogru Rivers Facility Group would be similar to that discussed above for the Fish-Judy Creeks Facility Group. The potential impacts might be less than those for the Fish and Judy creeks area because of the reduced amount of infrastructure in the Kalikpik-Kogru Rivers Facility Group. Road access from Nuiqsut may increase access and the potential for subsistence hunting to affect birds in the Kalikpik-Kogru Rivers Facility Group. Air strikes could cause additional mortality at the coastal airstrip at CD-29, particularly for waterfowl and seabirds.

There is evidence that researchers conducting studies on avian nest density and success may inadvertently affect the results by attracting predators to nests and broods (Bart 1977; Götmark 1992). Birds that are flushed from their nests during surveys could be more susceptible to nest predation than undisturbed birds. Ongoing activities by researchers could cause some mortality to tundra-nesting bird eggs and chicks. Increased aerial survey efforts from agency- and industry-sponsored studies to support development within the NPR-A could cause additional flushing and disturbance of pre-nesting waterfowl.

4A.3.3.3 Alternative A – Summary of Impacts (CPAI and FFD) on Birds

Potential impacts to birds associated with construction and operation of the proposed development include habitat loss, alteration, or enhancement; disturbance and displacement; obstructions to movement; and mortality. To determine the level of effect, we evaluated the nesting densities of bird species groups around the area of each proposed development and evaluated the number of nests potentially exposed to the action. In most cases, effects would involve a few individuals and would be localized, and no adverse effects to populations would be expected. Habitat loss does not involve the direct loss of active nests because winter gravel placement, ice-road construction, snow dumping, and snowdrifting occurs when nests are not active. Most impacts would be initiated during the construction period, including gravel placement, grading of the gravel surface, placement of all facilities, and initial drilling. The results of these activities for Alternative A for both the CPAI Development Plan and the FFD alternative are presented in Table 4A.3.3-5.

TABLE 4A.3.3-5 CPAI AND FFD ALTERNATIVE A – POTENTIAL BIRD NESTS DISPLACED BY HABITAT LOSS OR ALTERATION AND DISTURBANCE

CPAI Alternative A Totals					
Bird Group	**Gravel**	**Dust**	**Ice**	**Airstrip[a]**	**Total**
Waterfowl	9	3	5	6	23
Loons	1	0	1	1	3
Ptarmigan	1	0	0	1	2
Seabirds	1	0	1	1	3
Shorebirds	66	26	41	0	132
Passerines	31	13	21	0	65
Total Nests	109	42	69	9	229
FFD Alternative A Totals					
Bird Group	**Gravel**	**Dust**	**Ice**	**Airstrip[a]**	**Total**
Waterfowl	33	14	7	33	87
Loons	4	2	0	5	11
Ptarmigan	4	1	0	4	9
Seabirds	6	2	1	4	13
Shorebirds	272	101	70	0	443
Passerines	139	53	35	0	227
Total Nests	458	173	113	46	790

Notes:

[a] Disturbance at airstrips would potentially reduce nesting by 50% within 500 meters of the airstrip for waterfowl, loons, and seabirds. No disturbance was evident for shorebirds and passerines (Johnson et al. 2003b)

4A.3.3.4 Alternative A – Potential Mitigation Measures (CPAI and FFD) for Birds

Potential mitigation measures would be similar for the CPAI Development Plan Alternative A and the FFD Plan Alternative A.

Obstructions to Movements

Traffic speeds on roads would be reduced during brood-rearing.

Traffic levels would be reduced by limiting field access to industry only.

Mortality

Waterfowl and seabirds would be hazed away from active airstrips to prevent collisions with aircraft.

4A.3.4 Mammals

4A.3.4.1 Terrestrial Mammals

In this section we describe the potential impacts of Alternative A, considering general impact categories as in other recent impact assessments (TAPS Owners 2001; BLM 2002; BLM 2002a; PAI 2002). These categories include direct habitat loss, alteration, or enhancement; obstruction of movement; disturbance and displacement; and mortality. Impacts are addressed for the construction period, operation period, and FFD. It is important to recognize that several factors besides those directly associated with oilfield development and operations can affect the number and distribution of terrestrial mammals. These include range condition, distribution of forage, predation, hunting by humans, and other disturbances (Cronin et al. 1998a, BLM and MMS 1998a). In addition, population numbers and distribution and range condition may change, so impacts are potentially variable over time. Background information on terrestrial mammals in the Plan Area is presented in Section 3.3.5, but it is important to note the following general patterns for terrestrial mammals.

Alternative A – CPAI Development Plan Impacts on Terrestrial Mammals

In early May through late October 2001 and 2002, caribou were common in the vicinity of Fish and Judy creeks (Figure 3.3.4.1-6). During the calving period, appreciable numbers of caribou of the Teshekpuk Lake Herd (TLH) occur in the western part of the Plan Area around the Kalikpik and Kogru rivers, as far east as the Fish-Judy Creeks Facility Group (Jensen and Noel 2002; PAI 2002; BLM 2003; Figure 3.3.4.1-2). In the summer, after the calving period, the number of caribou in the Plan Area may vary from day to day. Caribou of the TLH use habitats in the Plan Area regularly during the summer, and large numbers of Central Arctic Herd (CAH) caribou sometimes enter the Plan Area from the east. Caribou of either herd may remain in the Plan Area, or move to other areas, over a period of hours or longer time periods (PAI 2002).

In October 2002 during the rut, caribou were concentrated in the south-central part of the Plan Area around Fish and Judy creeks (Burgess et al. 2002b). Caribou also use the Plan Area in the winter (Burgess et al. 2002b, 2003b). Telemetry data indicate that in winter, the densities of caribou in the Plan Area were greatest around the Kalikpik and Kogru rivers and in the south-central part of the Plan Area around Fish and Judy creeks and the Ublutuoch River (BLM 2003; Figure 3.3.4.1-3). These distributions indicate that development of Alternative A could affect caribou at any season.

Grizzly bears occur at low densities across the Plan Area. They are most commonly found in riparian areas (Figure 3.3.4.1-7) (Jensen and Noel, 2002; PAI 2002; Shideler and Hechtel 2000), but they could encounter oilfield infrastructure and activities anywhere in the Plan Area during summer.

Muskoxen are not common in the Plan Area but could occur there in varying numbers during the life of the project. Muskoxen use riparian areas, especially in winter. Small numbers of moose occur in the Plan Area, primarily along the Colville River, although their occurrence is rare during the summer (Johnson et al. 1999). Moose are found at higher densities upstream of the Plan Area in the inland reaches of the Colville River drainage (Figure 3.3.4.1-7; Carroll 2000a, as cited in BLM and MMS 1998a, 2003).

Arctic foxes occur throughout the Plan Area and often den along riparian corridors, ridges, and in pingos. Red foxes, wolves, and wolverines are less common than arctic foxes, but may also occur in the Plan Area. Small mammals (such as lemmings and voles) probably occur throughout the Plan Area. In general, riparian areas are important for all of the terrestrial mammals. Polar bears also occur in the Plan Area and are discussed with Marine Mammals in Section 3.3.5.2.

Important characteristics of Alternative A with regard to effects on terrestrial mammals include the following. Alternative A would include 25.8 miles of road and 33.1 miles of pipeline (Figure 2.3.3.1-1). The pipelines in Alternative A have an adjacent road, except the route to the CD-3 in the Colville River Delta. Alternative A would also have 76.2 acres of gravel pads/airstrips and 194.1 acres of gravel road. There would be one new airstrip in Alternative A at CD-3. The total gravel fill (pads, roads, airstrips) for Alternative A would be 270.3 acres. In Alternative A, pipelines would be elevated to 5 feet, and industry and local residents would use roads.

Construction Period

Much of the construction of the CPAI Development Plan Alternative A would occur in winter. The primary species that could be affected during the construction period are caribou, muskoxen, moose, foxes, and grizzly bear. In winter, grizzly bears will be in dens and thus might be affected only by disturbance from ice and gravel road construction, Rolligon activity, and pipeline installation within a mile of their current den. Improperly stored garbage and direct feeding by construction workers can cause food-conditioning in foxes and potentially locally increase fox populations. In winter, moose and muskoxen are uncommon in the Plan Area.

Direct Habitat Loss, Alteration, or Enhancement

The construction phase of the ASDP is scheduled to occur primarily during the winters between 2005 and 2010. Ice roads used for construction of roads, pads, and airstrips, and the areas covered with gravel, would comprise the areas of lost wildlife winter forage. Gravel fill has an impact on wildlife habitats in the Arctic because the loss of vegetation is long-term and revegetation of gravel sites may be difficult (PAI 2002). Areas covered with gravel are effectively removed as foraging habitats for terrestrial mammals until restoration of vegetation. However, gravel fill may create insect relief habitat for caribou (Pollard et al. 1996a, 1996b) and possibly other species (such as muskoxen and moose).

Alternative A would result in construction of gravel road to CD-4 in 2005, CD-6 in 2007, and CD-7 in 2009. Table 4A.3.4-1 lists the surface area that would be covered by gravel fill for pads, roads, and airstrips for the four action alternatives; Table 4A.3.4-2 lists the miles of roads and pipelines for each of the four action alternatives. Table 4.A.3.1-2 lists total surface areas for each type of habitat in the Plan Area that would be replaced by gravel fill for the four alternatives. Road gravel would already be in place for production pad construction of CD-5 in 2009. No road is planned to CD-3, so during 2005 and 2006, the pipeline would be constructed with access by ice road (about 35 feet wide).

TABLE 4A.3.4-1 APPROXIMATE ACRES OF GRAVEL FILL FOR PADS, ROADS, AIRSTRIPS, AND TOTAL FOR THE FOUR ALTERNATIVES

Alternative	Pads and Airstrips	Roads	Total
A	76.2	194.1	270.3
B	119.6	75.2	194.8
C	48.1	336.9	379
D-1	172.9	0	172.9
D-2	67.2	0	67.2

TABLE 4A.3.4-2 MILES OF ROADS AND PIPELINES FOR THE FOUR ALTERNATIVES

Alternative	Roads with Pipeline	Total Pipelines	Pipeline Without Road
A	25.8	35.5	9.7
B	10.0	34.0	24
C	41.0	41.1	0.1
D-1	0	34.6	34.6
D-2	0	34.6	34.6

The placement of gravel fill in Alternative A would reduce summer and winter forage available for caribou, moose, and muskoxen. Whether these species are currently limited by forage in any season has not been documented. However, given that caribou, muskoxen, and moose have occurred at relatively low densities in the Plan Area, particularly in winter, and the loss of forage is a small part of the Plan Area, this impact would be limited during the construction period. This could change as populations fluctuate and range conditions change. See the Operation Period subsection below for quantification of habitat types lost or altered beneath gravel fill.

Grizzly bears would lose some foraging habitat and denning habitat beneath the gravel fill placed under Alternative A (Burgess et al. 2003b, Figure 9). Because bears on the North Slope generally use a den only once (Shideler 2000) avoiding old dens during construction would not necessarily mitigate impacts. In general, the entire Colville River Delta is considered potential denning habitat for grizzly bears without specific high-concentration areas identified. The ADF&G has only recently expanded its study area to include the Northeast NPR-A, but areas along Fish and Judy creeks and the Kalikpik River appear to be used considerably for denning, judging by the number of dens used by both marked and unmarked bears in previous years. Potential loss of grizzly bear denning habitat under Alternative A is discussed in the Operation Period subsection below.

There are few data on site-specific den densities in the Northeast NPR-A, but aerial surveys within the Fish-Judy Creeks Facility Group found five bear dens within a 425-mi^2 (1,100-km^2) area (Burgess et al. 2003b, Figure 9).

All dens were within 2 miles of riparian areas. Three dens were near Fish Creek, and one den was near the Ublutuoch River. The dens were at least 3 miles apart. Denning habitat is probably scattered throughout the Plan Area, and some dens could be affected by development. However, there are no data to suggest that bears are limited by denning habitat within the Plan Area, so impacts during the construction period probably would be limited. Most bears collared in the NPR-A were found in the Ocean Point area. Results from a more recent effort by the ADF&G indicate that bears occur commonly throughout the Plan Area and that the riparian areas noted above are especially favored.

Fox dens also may be affected by construction activities. Within the Colville River Delta Facility Group in Alternative A, the road from CD-1 to CD-4 could be close to one inactive (summer 2002) red fox den (Johnson et al. 2003a). Within the vicinity of the Fish-Judy Creeks Facility Group, the pipeline/road complexes may be close to or may cover one inactive arctic fox den between CD-2 and CD-5, one inactive and two active arctic fox dens between CD-5 and CD-6, and three inactive and one active arctic fox den between CD-6 and CD-7. Sites suitable as potential denning habitat would likely be covered by gravel, but den site availability on the North Slope probably does not limit fox populations (Burgess 2000). Red foxes and arctic foxes have made dens in culverts and other oilfield structures on the North Slope (Burgess et al. 2002b). While this is beneficial to foxes, it is detrimental to waterfowl, and measures to protect waterfowl would likely minimize the benefit that could accrue to foxes.

Arctic foxes generally do not avoid human activity where they are not harassed or hunted. Arctic foxes may be particularly attracted to human activity or developed sites in winter when food is more likely to be scarce or they are seeking shelter (NRC 2003). Aggregations of foxes have been found in winter at garbage dumps on the North Slope and adjacent to other developed areas in the past (Burgess 2000). However, controls on feeding wildlife in the Plan Area as outlined by the BLM and MMS (1998b) and state regulation are designed to prevent foxes (and bears) from becoming habituated to human food, so this enhancement is likely to be limited. Management actions to prevent food-conditioning of bears and foxes, and monitoring for adherence to the plan, will be important for success.

Wolves, wolverines, and red foxes are uncommon in the Plan Area (Burgess et al. 2003b; Johnson et al. 1999) and the loss of habitat from construction activity would be limited (BLM 2003). Red foxes den annually in the ASDP Area, with approximately two or three dens per year on the Delta and probably a similar number in the NPR-A. Some small-mammal habitat would be lost beneath gravel fill and ice roads, but the number and habitats of small mammals are not well known.

Obstruction of Movements

Oilfield roads and pipelines could obstruct caribou movements to some extent during the summer and winter, but elevation of pipelines and separation of pipelines and roads have been effective mitigation measures during summer (Cronin et al. 1994; Murphy and Lawhead 2000). The TLH has not been exposed to oilfield infrastructure, and these mitigation measures might not be as effective as they are for the CAH.

Obstruction of movements during the winter construction phase may be more pronounced than during the operation period because of the relatively high level of traffic and other activity. In addition, snow accumulation under pipelines may increase the degree of obstruction. For example, in northeastern Alberta, roads obstructed caribou movements the most in late winter (Dyer et al. 2002). However, winter movements have not been obstructed by the TAPS (TAPS Owners 2001). In winter, caribou may seek areas with soft snow or windblown areas where snow tends to be shallow (Miller et al. 1982; Russell et al. 1993). Therefore, potential for obstruction of movements would be greatest if snow were deep during construction. Vehicle traffic on ice roads may be greater than one vehicle per minute during the construction phase of Alternative A, which could obstruct caribou movements to some extent.

Most of the CAH winters south and east of the Plan Area, and most of the TLH winters to the west and southwest of the Plan Area (PAI 2002). However, considerable numbers of TLH caribou use winter ranges in the western part of the Plan Area (Prichard et al. 2001, BLM 2003; Figure 3.3.4.1-3), and some obstruction of movements could occur between CD-2 and CD-7 during construction of the road and pipeline. Ice roads, vehicle traffic, and construction activities may also affect the movements of muskoxen and moose during construction, although few of these species are likely to occur in the Plan Area in winter.

Construction during winter would not obstruct movements of grizzly bears that are in dens at that time. Arctic foxes are generally tolerant of human activities and may roam widely throughout the winter, depending on food supplies (Burgess 2000). Construction activities during this time are not expected to affect their movements. Foxes could be attracted to construction activities out of curiosity, even if food is not available.

Construction activities and noise may temporarily alter the distribution and movements of wolves, wolverine, red foxes in the Plan Area. Wolves avoided highly traveled roads in the Kenai National Wildlife Refuge (NWR) but used closed or lightly traveled roads as travel corridors (Thurber et al. 1994). These species are not common in the Plan Area in the winter and impacts on them would be limited.

Disturbance and Displacement

In general, disturbance can be considered impacts that change behavior or cause stress in animals. Displacement refers to movement from one area to another in response to disturbance. It is important to note that dis turbance and displacement can vary in intensity and over time. The construction activity for Alternative A would result in some disturbance to the terrestrial mammals in the Plan Area. The level of disturbance would vary among species and be influenced primarily by habitat availability. If there is adequate alternative habitat, displacement may not affect animal health or survival. Displacement during winter, however, when energy budgets are negative, could have an additive effect and contribute to death by starvation.

Construction activity and new infrastructure may temporarily affect caribou movements and distribution (Mahoney and Schaeffer 2002). Maternal caribou are more sensitive to disturbance than those without calves, especially during the calving period (de Vos 1960; Bergerud 1974; Roby 1978; Haskell 2003). For example, some caribou cows with calves avoided the trans-Alaska pipeline corridor and oilfield roads during construction (Cameron et al. 1979; Dau and Cameron 1986b; Johnson and Lawhead 1989; Lawhead et al. 2003).

Construction of most of the Alternative A facilities in winter would avoid both the sensitive caribou calving period and the summer when the largest number of caribou are in the Plan Area (PAI 2002). Densities of overwintering TLH caribou in the vicinity of Judy and Fish creeks ranged from 0.3 to 0.75 caribou/km^2. Densities in summer (May – October) were 0.75 to 2.1 caribou/km^2 (Burgess et al. 2002b, 2003b). The areas south of the road to CD-7, near the Ublutuoch River, and in the vicinity of the Kalikpik-Kogru rivers have supported the highest densities of overwintering caribou in the Plan Area (BLM 2003, Figure 7). The Clover Potential Gravel Source, near the Ublutuoch River, might also support a high density of overwintering caribou. The potential disturbance associated with construction could cause the caribou in the vicinity to move more frequently and expend more energy (Smith et al. 2000). Caribou are relatively sedentary and less sensitive to disturbance during winter than during calving and summer periods, so these impacts would be limited (Skoog 1968; Dauphine 1976; Roby 1978). However, disturbance in the winter could still affect the animals negatively if it results in large energy loss or displacement to poor habitat.

Disturbance would be localized around construction sites and the road and pipeline corridors associated with CD-3 and CD-4 in the Colville River Delta and CD-5, CD-6, and CD-7 in the vicinity of Fish and Judy creeks. If there is winter hunting in the area, caribou may be more sensitive to human activities than in unhunted areas and may avoid all human activity, including construction areas.

Moose and muskoxen are likely to occur in small numbers in the Plan Area during winter, and some disturbance may result from construction activities, especially in riparian areas. There are few muskoxen west of the Colville River (Lenart 1999a), and the BLM (2003) identifies the "best potential habitat" for muskoxen south of the Plan Area (Figure 3.3.4.1-7). Studies on the North Slope show that undisturbed muskoxen tend to form larger groups and remain in a relatively small area in winter (27 to 70 km^2) than in summer (U.S. Geological Survey [USGS] 2002; Lenart 1999a). Female muskoxen drop calves in April and May before new vegetation emerges, and movement rates of satellite-collared animals were lowest at that time (Reynolds et al. 2002). The areas used in summer are significantly larger (223 km^2) than in winter or during the calving period (USGS 2002).

Moose use riparian areas, especially those of the Colville River upstream of the Plan Area, and numbers in the Plan Area are generally small (Figure 3.3.4.1-7; PAI 2002).

The relatively small numbers of muskoxen and moose and ample available habitat adjacent to the Alternative A infrastructure in the Plan Area suggest that disturbance and resulting displacement during winter construction would have limited impacts on these species.

Grizzly bears on the North Slope hibernate in dens beginning in late September and early November. They emerge in March to May. Bears in dens may be disturbed by the noise and activity during the winter construction associated with Alternative A (Reynolds et al. 1976, Shideler and Hechtel 2000). Grizzly bears hibernating in dens within a few miles of construction may be disturbed by noise from ice and gravel road construction, installation of pipelines, Rolligon traffic, and drilling operations (BLM 2003). Bears hibernating within 600 feet of construction activities may abandon their dens, which would result in negative impacts on those individuals (Reynolds et al. 1986; BLM 2003). Such bears might be able to re-den, or mortality could result. Spatial and temporal restrictions on development activities could prevent abandonment of dens (Amstrup 1993). For example, stipulations to avoid known dens by 0.5 mile would mitigate this impact for some bears. Densities of denning grizzly bears are low in the Colville River Delta and unknown in the Northeast NPR-A. Implementation of the 0.5-mile avoidance stipulation and the presence of available denning habitat away from the development area would minimize impacts on grizzly bears during construction.

Small-mammal densities are unknown but are probably variable over years and by habitat type. The effects of disturbance on these species would be limited to the areas of ice road and gravel deposition.

The distribution of arctic foxes in winter is largely influenced by the availability of food (Burgess 2000). Arctic foxes can habituate to human activity, so the effects of disturbance on foxes from winter construction would be minimal. However, if foxes are hunted, they might avoid human activity and be displaced from construction areas. Similarly, noise and traffic from construction activities could temporarily displace wolves and wolverines from construction areas. However, few of these species occur in the Plan Area, so impacts would be limited.

Mortality

Potential sources of mortality may include vehicle collisions, poisoning (for example, ingestion of industrial materials), disease (such as rabies in foxes) nuisance or defense-of-life-and-property (DLP) kills, and enhanced predation or hunting. Accidental road kills of caribou and bears in the existing North Slope oilfields are not well documented but are believed to be uncommon in comparison with other parts of Alaska (Murphy and Lawhead 2000; TAPS Owners 2001a). During the winter construction period, grizzly bears would be in dens, and wolves, muskoxen, and moose are relatively uncommon in the Plan Area, so direct mortality of these species would likely be limited. Some caribou occur in the Plan Area in winter, and road kills are possible. Foxes and other small mammals are also vulnerable to vehicle collisions, but the numbers affected during construction would be limited. Wildlife in the Plan Area has been exposed to hunting, so they may avoid human activity, which would reduce the chance of vehicle collisions, DLP mortality, or exposure to poisons. If any bears are displaced from denning locations they could either die by lack of nutrition or be dispatched in defense of life and property.

Operation Period

The same general impacts described in other oilfield operations are relevant to this project (BLM 1998a, 2003; TAPS Owners 2001a; Truett and Johnson 2000; BLM 2002). In this section on the Operation Period under CPAI Development Plan Alternative A, we briefly review the literature dealing with the impacts of oilfield operations on terrestrial mammals. This background material will apply to all Alternatives.

Direct Habitat Loss, Alteration, or Enhancement

The extent of habitat directly lost under Alternative A would be that covered by gravel fill and tundra excavated to obtain that gravel. This would include 270 acres of vegetation under gravel roads, pads, and the airstrip at CD-3 and approximately 65 acres of gravel mines. The primary habitat value lost would be forage for caribou, muskoxen, moose, and grizzly bear. As described below, the loss of forage for caribou, muskoxen, moose, and grizzly bear under gravel fill would be a small proportion of that available in the Plan Area. The amount of forage lost would probably be inconsequential to the animals using the Plan Area because alternative habitat would be available. Some natural denning habitat for grizzly bears and foxes could be lost, but anthropogenic (resulting from human activity) denning habitats for foxes could be created.

Caribou, muskoxen, moose, and grizzly bears use a variety of habitat types on the Coastal Plain. *Eriophorum vaginatum* (tussock cottongrass), *E. angustifolium* (tall cottongrass), *Carex aquatilis* (aquatic sedge), and *Salix planifolia* ssp. *pulchra* (diamond-leaf willow) have been identified as important forage plants for caribou in summer (Jorgenson et al. 2003, and references therein). These species occur in the two most important habitat types used by caribou during summer: Moist Sedge-Shrub Meadow and Moist Tussock Tundra (Section 3.3.4.1; Lawhead et al. 2003; Russell et al. 1993; Jorgenson et al. 2003). The Barrens habitat type primarily provides insect-relief to caribou in summer (Jorgenson et al. 2003), and a small amount of this habitat would be lost under gravel fill. However, insect relief habitats would also be created on gravel roads, pads, and in areas shaded by pipelines and structures. Some TLH and CAH caribou overwinter on the coastal plain (Davis and Valkenburg 1978; Prichard et al. 2001; PAI 2002). Potential loss of preferred caribou habitat types resulting from gravel placement under Alternative A are quantified below.

Muskoxen use a variety of habitats, depending upon the season. Sedges found in Moist Tussock Tundra and Moist Sedge-Shrub Meadow habitats are important forage plants for muskoxen in spring (Jingfors 1980; Reynolds et al. 1986; PAI 2002). Willow, forbs (that is, legumes), and sedges (Robus 1984; O'Brien 1988; PAI 2002) are important forage plants for muskoxen in late spring and summer. These plants occur in river terraces, gravel bars and shrub stands along rivers and tundra streams (Jingfors 1980; Robus 1981; PAI 2002). Muskoxen select upland habitats that allow access to food plants, such as places with shallow, soft snow cover in upland habitats near ridges and bluffs (Klein et al. 1993; PAI 2002). The most important habitat types for muskoxen on the Colville River Delta include the Riverine, Upland Shrub, and Moist Sedge-Shrub Meadow habitat types (PAI 2002; BLM and MMS, 2003 and references therein). Potential losses of preferred muskoxen habitat types resulting from gravel placement under Alternative A are quantified below.

Moose range from the northern foothills of the Brooks Range to the Arctic Coast in the summer and move to riparian corridors of large river systems in fall. They concentrate in those riparian areas in winter. The largest winter concentrations are in the inland reaches of the Colville River (Figure 3.3.4.1-7; Carroll 2000b). In spring, moose generally remain in riparian areas, but also move to other areas. The tall shrubs, including willow and alder shrub thickets, are important browsing species for moose, particularly in winter (Mould 1979; PAI 2002; BLM and MMS, 2003). These plant species occur in Riverine and Upland Shrub habitat types on the coastal plain, so these habitat types are important to moose. Potential losses of these preferred moose habitat types resulting from gravel placement under Alternative A are quantified below.

Hedysarum mackenzii (peavine roots) and various legumes (found in river terraces and bars) are important food sources for grizzly bears in the early spring. *Equisetum arvense* (field horsetail) and various grasses and sedges are important forage plants in summer, and *Arctostaphylos rubra* (bearberry) is important in late summer and early fall (Shideler and Hechtel 2000). These plant species occur in the Riverine, Upland Shrub, and Moist Sedge-Shrub Meadow habitat types and sometimes in the Barrens habitat type, all of which are important for grizzly bears (Shideler and Hechtel 2000; Jorgenson et al. 2003; PAI 2002 and references therein). The Riverine and Upland habitat types are used by grizzly bears for foraging and denning areas, travel corridors, and access to prey species (such as ground squirrels) (Johnson et al. 1996, Shideler and Hechtel 2000). Potential losses of these preferred grizzly bear habitat types resulting from gravel placement under Alternative A are quantified below. Other sites used by grizzly bears during the summer include ground squirrel mounds, meadows below snowbanks, and the ecotone between wet sedge and drier habitats (Shideler and Hechtel 2000). In addition to streambanks and hillsides, grizzly bears commonly den in pingos (Shideler and Hechtel 2000).

A total of 3,261 acres of Moist Sedge-Shrub Meadow are available in the Colville River Delta (PAI 2002). A habitat map is available for 171,861 acres in the NPR-A, but not for the entire area. The total area of Moist Sedge-Shrub Meadow in the habitat-typed area of the NPR-A is 39,920 acres (Jorgenson et al. 2003). A total of 46.82 acres (7.55 acres in the Colville River Delta, 39.27 acres in the NPR-A) of Moist Sedge-Shrub Meadow would be lost as a result of gravel placement (roads, pads and airstrips) under Alternative A (Table 4A.3.1-2). The potential loss of Moist Sedge-Shrub Meadow from gravel fill is less than 0.2 percent of that available on the Colville River Delta. The potential loss of habitat in the NPR-A cannot be calculated because a habitat map is not available for the entire area. However, the potential loss resulting from gravel fill in the habitat-typed area in the NPR-A is less than 0.1 percent of the Moist Sedge-Shrub Meadow habitat type avail able in that area. In addition to that habitat affected by gravel fill, 54.14 acres (10.55 acres in the Colville River Delta; 43.59 acres in the NPR-A) of Moist Sedge-Shrub Meadow would be altered by dust fallout.

The combined area of Riverine habitat type and Upland Shrub habitat type in the Colville River Delta is 6,814 acres (PAI 2002). The combined area of Riverine and Upland Shrub habitat types in the habitat-typed area in NPR-A is 5,390 acres (Jorgenson et al. 2003). A total of 7.46 acres (6.49 acres in the Colville River Delta, 0.97 acre in the NPR-A) of Riverine and Upland Shrub habitat types would be lost as the result of gravel placement (roads, pads, and airstrips) under Alternative A. The potential loss under gravel fill in the Colville River Delta and the habitat-typed area in the NPR-A is less than 0.1 percent of the Riverine habitat type and the Upland Shrub habitat type available in that area. In addition to gravel fill, 6.04 acres (4.91 acres in the Colville River Delta; 1.13 acres in the NPR-A) of Riverine and Upland Shrub habitat types would be altered by dust fallout.

A total of 627 acres of Moist Tussock Tundra habitat type is available in the Colville River Delta (PAI 2002). The total area of Moist Tussock Tundra in the habitat-typed area of the NPR-A is 47,102 acres (Jorgenson et al. 2003). No Moist Tussock Tundra would be lost or altered in the Colville River Delta under Alternative A. A total of 101.56 acres of Moist Tussock Tundra would be lost as the result of gravel placement (roads, pads, and airstrips) in the NPR-A. The potential loss from gravel fill in the habitat-typed area in the NPR-A is less than 0.1 percent of the Moist Tussock Tundra habitat type available in that area. In addition, 107.22 acres of the Moist Tussock Tundra habitat type would be altered from dust fallout in the NPR-A.

The total area of Barrens habitat type in the Colville River Delta is 19,440 acres (PAI 2002). The total area of Barrens in the habitat-typed area of the NPR-A is 1,698 acres (Jorgenson et al. 2003). A total of 4.54 acres of Barrens would be lost as the result of gravel placement (roads, pads, and airstrips) in the Colville River Delta, and no Barrens would be lost or altered in the NPR-A under Alternative A. The potential loss of Barrens habitat is less than 0.1 percent of that available in the Colville River Delta. In addition to Barrens habitat lost as the result of gravel fill in the Colville River Delta, 2.53 acres of Barrens habitat type would be altered by dust fallout under Alternative A.

In the operations at Prudhoe Bay and adjacent oilfields, caribou use elevated gravel pads and roads as insect-relief habitat infrequently during the mosquito season and more commonly during the oestrid fly season (Pollard et al. 1996a; Noel et al. 1998; Murphy and Lawhead 2000). Such use of the roads and pads developed under Alternative A could increase potential insect relief habitat in the summer. However, since relatively few caribou occupy during insect season the area proposed for development, it is uncertain that this would represent any population-level benefit. Other habitat alterations that could benefit caribou could also occur. Caribou could be attracted to areas of early snowmelt and plant emergence near roads in spring where dust settles (Roby 1978; Lawhead and Cameron 1988; Smith et al. 1994) or areas near infrastructure where impounded water or accumulated snow cause delayed plant phenology and senescence (Roby 1978). However, there could be an increased risk of vehicle collision associated with this behavior. Also, caribou might use patches of persisting snow next to pipelines for relief from heat in June (Haskell 2000, pers. comm.).

Oilfield operations in the Prudhoe Bay area appear to have increased the availability of food, shelter, and possibly numbers of grizzly bears and arctic foxes (Shideler and Hechtel 2000; Burgess 2000). However, many of the bears raised as food-conditioned bears have been killed in recent years by hunters or in DLP incidents (Shideler and Hechtel 2000). The density of arctic fox dens and offspring productivity was significantly higher in the Prudhoe Bay oilfield than in undeveloped areas to the east (Eberhardt et al. 1983; Burgess et al. 1993; Ballard et al. 2000). Foxes are attracted to garbage dumpsters as a source of food and may also den or seek shelter beneath buildings, in culverts, or in other structures (Burgess 2000).

Disturbance and Displacement

During the operation period of Alternative A, terrestrial mammals may be disturbed and displaced by vehicular traffic, low-flying aircraft, unfamiliar infrastructure, noise and activity on facilities, road and pipeline mainte nance, and humans on foot (Shideler 1986). Humans on foot tend to elicit the most regular flight responses of caribou (Roby 1978; Murphy and Lawhead 2000).

It is possible that disturbance would displace caribou to areas of poor forage or insect-relief value. However, there is probably adequate habitat in the Plan Area away from Alternative A infrastructure to maintain the numbers of animals that have used the Plan Area in the past.

Disturbance and displacement of caribou of the CAH in the Prudhoe Bay, Kuparuk, and Milne Point oilfields have been studied extensively. Cow caribou with calves tend to be most sensitive to disturbance during the calving period in late May until approximately 20 June. In this period, displacement 1 to 4 kilometers (km) away from roads with traffic (Dau and Cameron 1986; Cameron et al. 1992b) and a general shift away from development have been reported (NRC 2003; USGS 2002; Murphy and Lawhead 2000; Lawhead et al. 2003). Others have also reported that caribou cows with calves generally avoid areas of human activities by up to 1 km and are sensitive to human-caused disturbance (Johnson and Lawhead 1989; de Vos 1960; Lent 1966; Bergerud 1974). However, studies in the Milne Point oilfield during the calving periods from 1991 to 2001 do not show displacement from roads (Haskell 2003; Noel et al. submitted). With regard to general shifts to ranges away from development, it is possible that factors other than the oilfields are the cause of displacement from the developed area (Murphy and Lawhead 2000). Factors such as timing of snowmelt, range conditions, and animal population density could also result in shifting of calving areas.

Displacement of caribou from the oilfields during the post-calving summer period has also been reported (Cameron et al. 1995, 2002). However, habitats in the Prudhoe Bay oilfield are used frequently by caribou without displacement from infrastructure in the post-calving period (Pollard et al. 1996b; Noel et al. 1998; Cronin et al. 1998a, 1998b). During the post-calving period, CAH caribou of all sex and age classes frequently forage and rest near and on gravel roads and pads or in the shade of oilfield buildings and pipelines (Lawhead et al. 1993; Pollard et al. 1996b; Cronin et al. 1998a, 1998b; Noel et al. 1998; Ballard et al. 2000; Haskell, 2003).

Recent impact assessments have led to the hypothesis that displacement from oilfield infrastructure during the calving period may affect the nutritional status of cow caribou and result in reduced calf production and reduced herd growth. In particular, comparison of caribou in contact with oilfields (west of the Sagavanirktok River) and not in contact (east of the Sagavanirktok River) have suggested such effects (Cameron et al. 2002; Griffith et al. 2002; NRC 2003). However, the CAH has grown from approximately 5,000 to 32,000 animals since the beginning of oilfield development. The numbers of animals in the western part of the calving range with oilfields has increased along with the entire herd, and the calf/cow ratios in the oilfield areas have been as high or higher than in undeveloped areas (Maki 1992; Cronin et al. 1998a, 2000, 2001). The TLH and the Western Arctic Herd in northern Alaska have exhibited faster population growth than the CAH during the same time frame, but the Porcupine Caribou Herd grew during the 1970s and 1980s and has declined since 1990 (Cronin et al. 1998a; NRC, 1990, 2003). Factors such as population density, range condition, and movements of animals between east and west areas are likely responsible for change in numbers of animals (Cronin et al. 1997).

Other studies of disturbance of caribou in oilfields provide additional insights. Roby (1978) found that caribou changed behavior within 656 to 984 feet of the Dalton Highway depending on sex, age, and time of year. Lawhead and Murphy (1988) and Lawhead (1990) reported that under varying levels of insect harassment and road traffic about 83 percent of acute disturbance events occurred within 328 feet of the Endicott Road in the North Slope oilfields. Haskell (2003) reported that 90 percent of the behavioral reactions to humans occurred within 1,640 feet of the observer's vehicle. Murphy and Curatolo (1987) determined that moving stimuli such as vehicles were more disruptive to caribou behavior than stationary infrastructure such as pipelines and roads. It is important to note that disturbance reactions may vary and caribou might habituate to human activity, including oilfields (Bergerud et al. 1984; Cronin et al. 1994). Shideler (2000) noted that CAH caribou habituated to development over several years. Haskell (2003) reported that rehabituation of CAH caribou occurred annually and the timing and extent of habituation was positively correlated with the timing of spring snowmelt.

The activities associated with Alternative A may cause some displacement and disturbance of caribou in the Plan Area. These impacts have been the greatest during the calving period in the existing oilfields (USGS 2002; NRC 2003). Because little calving occurs in the areas to be developed in Alternative A (Figure 3.3.4.1-2), few impacts during the calving period are expected. Caribou could be disturbed and displaced during the post-calving period and winter when more caribou are present. Vehicle traffic on the roads between CD-1 and CD-4 and between CD-2 and CD-7, as well as activity on the facility pads and the airstrips, could disturb caribou. The pipeline without a road between CD-1 and CD-3 would not disturb caribou after construction (Cronin et al. 1994; Murphy and Lawhead 2000), but aircraft operations between these sites could. Aircraft supporting operations of Alternative A can be expected to add disturbance, particularly near the airstrip at CD-3 when at flights are at low altitude. However, there would be less aircraft traffic under Alternative A than Alternatives B and D because of the greater road access.

Lack of previous exposure of the TLH to oilfields may result in more disturbance and displacement than that of the CAH in the existing oilfields. This sensitivity may lessen with time as the TLH animals habituate to the oilfield activity and infrastructure (Cronin et al. 1994). This appears to have occurred with the CAH. Animals from the CAH also use the Plan Area and may already be habituated to oilfield activity. Conversely, use of the Alternative A project roads by local residents in addition to industry may result in higher levels of traffic and increased disturbance. This may be particularly important if the local residents are hunting and cause caribou and the other terrestrial mammals in the Plan Area to avoid human activity.

Grizzly bears will usually avoid roads and areas of human activity (Harding and Nagy 1980), and their initial reaction to humans on foot is usually to flee. However, they may become habituated to noise and human activity over time, which would increase the likelihood of human-bear interactions (McLellan and Shackleton 1989; Shideler and Hechtel 2000). Grizzly bears often run or hide in response to aircraft (McLellan and Shackleton 1989; BLM 2003). Responses vary among individual bears depending on availability of cover, habituation, and aircraft flight characteristics (Harting 1987). Capturing associated with biological research may sensitize bears to disturbance from helicopters.

The existing North Slope oilfields have substantially increased the number of human-bear interactions (NRC 2003). Bears have been killed by hunters after habituation to people, and some bears have been killed in the oilfield because of safety concerns (Shideler and Hechtel 2000). Disturbance and displacement of grizzly bears during Alternative A operations would primarily be from road traffic between CD-2 and CD-7 and between CD-1 and CD-4, increased levels of human activity and noise at production sites, and aircraft at CD-1 and CD-3. This could include disturbing bears in winter dens. Increased traffic by local residents may increase the level of disturbance. Increased bear-human interactions with associated DLP kills could result from the Alternative A development, although controlling access of bears to garbage, as required by the BLM and the state, can minimize this impact (BLM 1998b).

Muskoxen show initial disturbance reactions to aircraft, traffic, snowmobiles, and human activity. When disturbed or threatened, muskoxen may gather together in a tight circle, charge, or run away (Miller and Gunn 1984; McLaren and Green 1985). In addition, helicopters and low-flying aircraft can cause muskoxen to stampede and abandon their calves (Winters and Shideler 1990). Muskoxen reacted when snowmobiles approached to within an average of 1,132 feet, and some animals reacted to snowmobiles when 0.6 mile away. Muskoxen reacted to larger vehicles as far as 0.8 mile away (McLaren and Green 1985). Muskoxen are most sensitive to disturbance during the winter months when they restrict their movements and activity and select a small home range with low snow cover (Reynolds et al. 2002).

Female muskoxen calve in April and May before the new vegetation emerges and must be in good body condition at calving to successfully rear offspring (Reynolds et al. 2002). Repeated disturbance to the same group of muskoxen during the late winter or early spring could have adverse effects on reproductive success and winter survival rates (BLM 2003).

Miller and Gunn (1984) observed some short- and long-term habituation to repeated helicopter overpasses at greater than 180 meters altitude. Habituation to road traffic has been noted along the Dalton Highway, where small groups of muskoxen are frequently seen during the summer near the road (Nowlin 1999). There is also evidence that muskoxen can habituate to human activity associated with oilfields. During June road surveys for caribou in 2001, a group of 25 muskoxen including 8 calves was frequently observed within 0.6 mile of roads or pads in the Milne Point oilfield (S. Haskell, LGL Alaska Research Associates, Inc., unpublished).

Air and ground traffic associated with Alternative A may disturb muskoxen and displace them from some habitats. There are generally few muskoxen in the Plan Area, and there are alternative habitats away from the proposed roads and facility pads, thus limiting impacts. However, muskoxen use riparian zones, particularly in the winter, so the road/pipeline crossings of streams and rivers between CD-2 and CD-7 could affect the animals in the area. Also, the CD-1, CD-2, CD-3, and CD-4 facilities in the Colville River Delta could be a source of disturbance.

Arctic foxes have habituated to the Prudhoe Bay oilfields and development activities (Burgess 2000). They might continue to use breeding dens even when roads or production pads are constructed nearby (Burgess 2000). Litters have been successfully raised within 25 meters of heavily traveled roads and within 50 meters of operating drill rigs (NRC 2003). The roads and facilities proposed in Alternative A may provide denning habitat for foxes. Access to garbage could cause increased population densities of foxes, but proper refuse management, as mandated by the BLM and the state, would mitigate this impact. If hunting and trapping occur from the Alternative A roads, human activity could be avoided.

Potential effects on wolves and wolverines include disturbance by air and surface-vehicle traffic and human presence (BLM 2003). The species may abandon habitats near vehicle or aircraft traffic or increased human activity (BLM 2003). Changes in caribou distribution and increased hunting or trapping pressure may also affect wolf and wolverine distribution. Because of low numbers in the Plan Area, Alternative A development within the Plan Area would likely affect few wolves or wolverines.

Obstruction to Movements

Roads with traffic and adjacent pipelines would be the primary obstructions to movements of terrestrial mammals. Obstruction to movements caused by oilfield infrastructure has been described in other assessments, and these findings generally will apply here (Cronin et al. 1994; BLM and MMS 1998a, 2003; TAPS Owners 2001a; Murphy and Lawhead 2000; BLM 2002). Factors that influence the success of caribou crossing roads and pipelines include levels of vehicle traffic, road and pipeline configuration, the size or composition of the group of caribou, insect activity, topography, and learning by the caribou (Curatolo 1975; Fancy 1983; Cronin et al. 1994). Low (less than 4 feet above ground) pipelines, such as some found in older areas of the Prudhoe Bay oilfield, can block caribou movements in summer and may exclude caribou from some areas (Cameron et al. 1995; Murphy and Lawhead 2000). However, mitigation measures such as elevating pipes to at least 5 feet above the ground and separating roads from pipelines by at least 300 feet generally alleviate such problems (Curatolo and Murphy 1986; Cronin et al. 1994; Murphy and Lawhead 2000). Although caribou cross under pipes elevated more than 5 feet, the pipes may delay or deflect caribou movements before crossing. Curatolo and Murphy (1986) found that, regardless of traffic level, caribou crossing pipelines did not appear to select particular heights within the range of 5 to 14 feet above ground. When compared to control sites, percentages of caribou crossings were significantly lower only when roads with moderate or heavy traffic and a pipeline were directly adjacent (Curatolo and Murphy 1986, review by Frid and Dill 2002). Pipeline-crossing studies (Cronin et al. 1994; Curatolo and Murphy 1986; Lawhead and Murphy 1988; Lawhead 1990; Lawhead and Smith 1990) indicate that although caribou seem to readily cross under pipes elevated 5 feet, they more readily cross higher pipes. Gravel ramps over pipelines appear unnecessary where pipelines are elevated at least 5 feet (Cronin et al. 1994). Caribou under insect harassment are relatively insensitive to human disturbance, and will readily cross infrastructure to access relief (Ballard et al. 2000). Crossing success tends to be higher during the oestrid fly season when caribou groups are generally smaller than during the mosquito season (Smith and

Cameron 1985a, Curatolo and Murphy 1986). Also, caribou habituate to development over time and appear to have learned to navigate through oilfield infrastructure in the Prudhoe Bay region (Cronin et al. 1994; Shideler 2000; Ballard et al. 2000).

When caribou are deflected by roads and pipelines, they appear more likely to cross at intersections with natural barriers such as lakes (Smith and Cameron 1985b). Crossing success can be higher at long buried sections of pipelines, particularly early in the life of a project when infrastructure is a novelty to caribou (Smith and Cameron 1985; Cronin et al. 1994). However, burying pipes within or adjacent to roadways can be expensive and can cause thermal instability of the fill and underlying substrate (Cronin et al. 1994).

During periods of snow cover in interior Alaska, caribou crossings of the trans-Alaska pipeline were less than expected for pipe sections less than or equal to 6.9 feet above ground (Eide et al. 1986; Carruthers and Jakimchuk 1987). Snow depths averaged 20.5 inches, and the trans-Alaska pipeline is a larger-diameter (4 feet) pipe than those proposed in the Plan Area (less than 2 feet). Differences in visual effects between pipe diameters and snow depths may alter caribou behavior and crossing success. Snow settles under and adjacent to pipelines depending on orientation of the pipeline and wind direction. On Alaska's North Slope, windward scouring and leeward deposition of snow occur around physical structures on the landscape (Li and Sturm 2002). In late spring 1982, snow under much of the 30-km east-west Kuparuk pipeline accumulated to create an impassible barrier to caribou (Smith and Cameron 1985a). Also, drifting snow around a pipeline could result in easier access to forage in wind-scoured areas beneath or windward of the pipeline. In March and April 2001, with slightly greater than annual average snow depths (about 10 inches), Pullman and Lawhead (2002) found that pipelines oriented east-west caused greater accumulation of snow than pipelines oriented north-south. Snow accumulated to significantly greater depths than controls at 25 percent of sites surveyed under pipelines, and 18 percent of sites had significantly less snow accumulated than control sites (Pullman and Lawhead 2002). Clearance under pipes was lowest in areas where snow accumulates naturally such as in low thaw basins and in the lee of small-scale topographic relief. Pipelines oriented parallel to prevailing winds may cause decreased wind speeds and more settling of snow. Also, pipelines in the lee of roads may collect more snow. Higher pipes may reduce snow accumulation, and maintenance of ice roads directly adjacent to pipelines can affect snow accumulation under pipelines (Pullman and Lawhead 2002). Pullman and Lawhead (2002) found that snow depths in the Colville River Delta were less than those adjacent to the Alpine pipeline and Tarn pipeline corridors to the east. With greater topographic relief west of the Colville River compared to the area east of the river, sites with natural snow drifting and scouring may be more common. This may explain why large numbers of caribou overwinter on the coastal plain west of the Colville River but not to the east (Haskell et al. 2002).

Even when pipelines are elevated and separated from roads, high levels of traffic (more than 15 vehicles per hour) can disrupt movements of caribou, especially when large groups aggregate during mosquito harassment (Johnson and Lawhead 1989; Smith et al. 1994; Murphy and Lawhead 2000). Delayed movements between coastal insect-relief habitat and inland foraging areas, particularly during the mosquito season, could have negative consequences on energy balances of caribou (Smith 1996; Murphy et al. 2000). This could affect reproductive success of females (Nelleman and Cameron 1998; Cameron et al. 2002).

Grizzly bears might avoid areas of human activity such as high-traffic roads or noisy drilling sites (McLellan 1990). Grizzly bears have been displaced from roads in Alaska, British Columbia, Montana, and Yellowstone National Park, with individual bears avoiding areas within 0.6 mile of roads in most cases (TAPS Owners 2001). There is no evidence to suggest that pipelines restrict grizzly bear movements, and some bears have been observed walking along the top of the elevated Badami pipeline (Noel et al. 2002).

Muskoxen in the Colville River drainage spend the winter in the Itkillik Hills to the southeast of the Plan Area. In summer, some muskoxen (predominantly small male-dominated groups or lone bulls) travel up the Itkillik River into the vicinity of Colville River Delta and Fish and Judy creeks (Johnson et al. 1997; Burgess et al. 2002). Muskoxen generally move less than 3 miles per day, although they may move 6 miles per day between seasonal ranges (Reynolds 1992, 1998). Since reintroduction into the Arctic NWR, muskoxen have moved as far west as the Colville River and are expected to continue expanding into the NPR-A (TAPS Owners 2001; BLM 2003). This range expansion required crossing the Dalton Highway and trans-Alaska pipeline or the Prudhoe Bay and Kuparuk oilfields and indicates that muskoxen are capable of crossing roads, pipelines, and other infrastructure.

Caribou, moose, and muskoxen may occur in the Plan Area during all seasons of the year. Depending on the rate of vehicle traffic, movements may be obstructed by the road and pipelines from CD1 to CD4 and from CD2 to CD7. With both industry and local residents using the roads, traffic levels would be higher than in Alternative B in which there is no use by local residents and Alternative D in which there are no roads. Caribou generally cross roads with pipelines elevated greater than 5 feet as proposed in Alternative A. Previous studies suggest that neither the road/pipeline combinations nor the pipeline without a road in Alternative A would cause major obstruction of caribou movements (Cronin et al. 1999; Murphy and Lawhead 2000). However, some caribou, particularly in large groups (as may occur during summer when CAH animals move into the Plan Area) may be deflected by the road/pipelines. Caribou under insect harassment are relatively insensitive to human disturbance, and will readily cross oilfield infrastructure to access relief (Ballard et al. 2000; Cronin et al. 1999; Murphy and Lawhead 2000). Muskoxen can cross elevated pipelines, although the success of crossing with different road/pipeline configurations has not been specifically assessed (PAI 2002). Moose are not generally obstructed by the trans-Alaska pipeline (TAPS Owners 2001a) and probably would cross roads and pipelines in the Plan Area without much difficulty. Under Alternative A, power lines would be on the pipeline VSMs and should not obstruct wildlife movements. In addition, crossing of elevated pipelines without roads, such as the pipeline from CD-1 to CD-3, would probably not be impaired (Cronin et al. 1999).

Compared with the CAH, which has had oilfields in its summer range for more than 20 years, TLH caribou are largely inexperienced with traversing oilfield infrastructure and associated human activities. Therefore, obstruction of movements of TLH caribou in the Plan Area may occur early in the project. Under Alternative A, the northern portion of the Colville River Delta would remain roadless, so caribou should have little problem moving there during the mosquito season. The road and pipeline from CD-2 to CD-7 could cause some short-term delay to TLH caribou over the life of the project, particularly during winter (Dyer et al. 2002). Large groups of TLH caribou (hundreds to thousands) during the mosquito season may be found northwest of the Plan Area and possibly near the coast within the Kalikpik-Kogru Rivers and Fish-Judy Creeks facility groups. Smaller groups of caribou may be present near the proposed gravel access road to CD-7 and associated production sites year-round. The largest groups of caribou in the Plan Area typically occur in the Colville River Delta when warm weather and westerly winds bring hundreds or thousands of CAH caribou westward (PAI 2002). These caribou could be delayed in crossing the road/pipeline between CD-1 and CD-4 and between CD-2 and CD-7.

To mitigate effects of road/pipeline corridors on caribou movements, BLM (1998b) stipulates that pipelines within the Northeast NPR-A shall be elevated at least 5 feet above the ground and separated from roads by a minimum of 500 feet, where feasible. Separation of 500 feet may not be feasible where lakes constrict corridor space and where pipes and roads converge at facilities.

Because caribou use the Plan Area during the winter, crossing of the road/pipeline combination at that time of year is of concern because snow accumulation may effectively reduce clearance or create a visual barrier. Because east-west-oriented pipelines could cause greater accumulation of snow than north-south-oriented pipelines, the pipeline segment from the Ublutuoch River west to CD-6 may collect more snow than the pipelines from CD-1 to CD-3 and CD-4. Thus, Alternative A (with pipelines elevated to 5 feet) may result in greater obstruction to movement than Alternatives C and D (with pipelines elevated to 7 feet).

Muskoxen moving into the Colville River Delta could be deflected by the pipeline to CD-3 and associated infrastructure. Muskoxen in the Ublutuoch River area could encounter the road and pipeline between CD-5 and CD-7. Reactions of muskoxen to roads with traffic and pipelines have not been studied, so these potential impacts can not documented. It is possible that roads with pipelines would deflect or obstruct movements of muskoxen, as they can with caribou. However, it is unlikely that movements would be totally obstructed, and muskoxen can be expected to cross the facilities.

Arctic foxes move relatively unimpeded through existing developed areas on the North Slope and would be expected to do the same in the Plan Area. The movements of red foxes and other small mammals are expected to be similarly unaffected. Movements of wolves and wolverines through the Plan Area are not well understood, but both species may avoid areas of human activity, especially where hunted (Thurber et al. 1994; BLM 2003).

Mortality

Mortality to terrestrial mammals from the Alternative A development could result primarily from vehicle-collisions, DLP kills, and increased hunting access. Vehicle collisions with all terrestrial mammals should be relatively rare with proper driver training and adherence to industry safety regulations. Because caribou and muskoxen may be in the Plan Area in winter, year-round attention is necessary.

With proper garbage management, as required by the BLM and stipulations and state regulations, the Alternative A development should not artificially increase the numbers of grizzly bears or foxes. Therefore, increased predation on caribou, muskoxen, or moose (including calves) would probably not result from Alternative A. The increased presence of oilfield workers increases the probability of human-bear encounters and DLP kills, even if the bear numbers do not increase (NRC 2003; BLM 2003). The mortality rate of food-conditioned bears in the Prudhoe Bay oilfields is significantly higher than for bears that feed on natural foods (Shideler and Hechtel 2000). Controls on feeding wildlife in the Plan Area as outlined by the BLM (1998b) are designed to prevent bears and foxes in the Plan Area from becoming food-conditioned, to minimize human-wildlife interactions, and to prevent DLP killings. Strict adherence to these policies and rigorous monitoring should minimize the potential for food conditioning bears and foxes.

The presence of rabies in foxes may also result in control actions that kill foxes. Wolves are scarce but would likely avoid human activities in this area and would not directly experience increased mortality as a result of Alternative A. However, under Alternative A, roads would be open to local residents, potentially increasing hunting and trapping mortality.

Alternative A – Full-Field Development Impacts on Terrestrial Mammals

The total amount of gravel fill under Alternative A would be approximately 1,400 acres. Because neither detailed site locations nor habitat mapping are available, we cannot quantify specific terrestrial mammal habitat lost under Alternative A. However, more acreage is coverage with gravel in Alternative A than in Alternatives B and D. A large portion (66 percent) of the Alternative A gravel would be roads, with associated impacts.

Colville River Delta Facility Group

Direct Habitat Loss, Alteration, or Enhancement

In the Alternative A FFD scenario, direct habitat loss to gravel fill in the Colville River Delta Facility Group other than described in the ASDP would include approximately 8 miles of road to access CD-11 and CD-12 as well as gravel for seven production pads, about 10 acres per site. Four of the sites on the northern half of the Delta (in addition to CD-3) would be without roads but would also require gravel fill for airstrips and connecting pipelines. This gravel fill would result in the loss of potential forage for caribou, muskoxen, and moose. Winter ice roads would also cover potential forage during that time of year. The amounts of forage lost would be small relative to that available throughout the area. The increased number of gravel pads, roads, elevated pipelines, and structures would provide some insect-relief habitat, including shaded areas.

The impacts to habitats of other terrestrial mammals would be similar to those described previously in the section on the CPAI Development Plan but would be over the larger FFD area. This includes loss of tundra habitats under gravel fill and increases in potential den sites for foxes. It is unlikely that the amount of habitat for any terrestrial mammal would be significantly increased or decreased to the extent that it would affect the numbers of animals occurring in the Plan Area.

Disturbance and Displacement

The construction phase of FFD would take place primarily during winter months but over a longer time period than the ASDP, so there is the potential for longer-term disturbance to terrestrial mammals. Caribou do not occur frequently in the winter in the Colville River Delta, so disturbance during construction and winter operation should be limited. Denning grizzly bears are subject to disturbance in winter, and this may happen during FFD. Similarly, industry-related disturbances during operation on calving caribou would be minimal because few caribou are in the Colville River Delta during this time. During the post-calving season, some caribou could be disturbed by operations when large numbers of animals move into the area. However, the lack of roads would remove potential effects of vehicle traffic. Air traffic would result in some disturbance of caribou in the area during the summer. Moose, muskoxen, and grizzly bears could be disturbed somewhat during the summer months. This disturbance may be exacerbated by increased traffic from local residents, who could use the roads associated with the new development, such as those to hypothetical pads CD-11, CD-12, and CD-15.

Obstruction to Movements

During the winter construction phases of FFD, traffic on ice roads could obstruct movements of caribou. However, winter densities of caribou are low in the Colville River Delta (BLM 2003, Figure 7), so this impact would be limited. Construction during FFD also has the potential to affect the movements of moose and muskoxen in the Colville River Delta Facility Group, but both of these species usually winter to the south of the Plan Area (Burgess et al. 2002; BLM 2003). Few caribou occur in the Colville River Delta Facility Group during calving, so obstruction of movements from operations would be minimal at that time. However, large numbers of caribou may move into the Delta during the post-calving season. Moose and muskoxen also use the Colville River Delta during summer. Most FFD in the Delta, especially in the northern portion, would include only pipelines without roads to the CD-3, CD-14, CD-19, CD-20, and CD-21 facilities. These pipelines would be elevated to 5 feet and, without associated roads, should allow free passage of caribou. Roads/pipelines to CD-11, CD-12, and CD-15 may obstruct local movements to some extent, but as discussed previously, elevated pipes usually allow passage of caribou. Overall, the limited number of roads in Alternative A FFD would limit the extent of obstruction of movements of terrestrial mammals in the Colville River Delta.

Mortality

Road kills should be few in the Colville River Delta Facility Group because there are few caribou, muskoxen, or moose present in winter when construction would occur, and there are no roads to the production sites during operations in the northern part of the area. Some vehicle-caribou collisions could occur during summer along the roads to CD-11, CD-12, and CD-15. There is potential for increased human-bear encounters and exposure to foxes with rabies at FFD production sites. This may result in mortalities of these species.

Fish-Judy Creeks Facility Group

Direct Habitat Loss, Alteration, or Enhancement

FFD under Alternative A would have additional roads and pads in the vicinity of Fish and Judy creeks. This would cover greater amounts of habitat than the ASDP alone (Figure 2.3.3.1-1). Habitats directly lost for foraging activities are as described previously in the CPAI Development Plan Impacts section. However, the proportion of habitat to be covered is small relative to that in the entire area. Terrestrial mammals in the Plan Area would likely not experience a major loss of habitat as a result of gravel placement. Caribou might selectively use elevated gravel sites as insect-relief habitat, and areas near infrastructure for foraging where plant phenology might be altered and forage could remain available later in the year. Effects of habitat alteration on terrestrial mammals would be the same as described in the ASDP section but over a larger area and over a longer period of time.

Disturbance and Displacement

There is the potential for disturbance and displacement of caribou and other terrestrial mammal species in the Fish-Judy Creeks Facility Group, as in the CPAI Development Plan areas. The production facilities and road/pipelines connecting them throughout the area may impose new disturbance on caribou during the summer and winter. The level of impact would probably be greatest during the construction periods (in winter) and would depend in summer on levels of vehicle traffic. Few caribou have calved in this area, but use could increase in the future. Traffic on roads could result in displacement of calving caribou.

The experience in existing oilfields as described previously in the ASDP sections suggests that caribou would not abandon or avoid FFD in the Fish-Judy Creeks Facility Group as summer habitats. As FFD progresses and TLH caribou are exposed to oilfield disturbance, habituation could proceed as with the CAH. If hunting were to take place near FFD oilfields, habituation might not occur and avoidance of human activities could increase.

Disturbance and displacement of grizzly bears, muskoxen, moose, wolverines, and wolves can be expected to be similar to that described for the CPAI Development Plan Alternative A, but under FFD disturbance and displacement would be spread across a broader area. Development in riparian habitats such as those near Judy Creek and Fish Creek can be expected to have a proportionally greater impact on these species, because they are often associated with those habitats. Road access for hunters and trappers has the potential to increase negative effects of road development in the Fish-Judy Creeks Facility Group.

Obstruction to Movements

The Fish-Judy Creeks Facility Group is in the eastern edge of the TLH range, but many animals of the TLH use this area. Densities of overwintering caribou have been highest in the past near the Ublutuoch River by the prospective CD-17 and CD-18 sites in the Fish and Judy creeks area (BLM 2003). Considerable numbers of caribou have also used the northern portion of the Fish and Judy creeks area during the summer. The CD-22, CD-8, and CD-10 production pads and road/pipelines connecting them could obstruct caribou movements, although pipelines are elevated to 5 feet and separated from the road by more than 300 feet. Relatively small groups of TLH caribou might selectively use riparian areas such as Fish Creek and Judy Creek during the oestrid fly season (Burgess et al. 2003). The proposed gravel access roads to the hypothetical APF-2 and CD-26 sites would cross Fish and Judy creeks and parallel Judy Creek. Temporary obstructions to movements of some caribou could be expected, and caribou also could use infrastructure for insect-relief habitat. Increased traffic on the roads from local residents and industry use may cause some obstruction if at high enough levels. Few calving caribou have occurred in this Facility Group area, so impacts during the calving period would be limited.

The greatest density of caribou reported in the Plan Area in recent years was in July 2001 when about 6,000 CAH caribou moved west through the area of Fish and Judy creeks in response to warm temperatures and westerly winds. CAH caribou would probably be more experienced at crossing oilfield infrastructure than TLH caribou, especially early in the life of the project. Roads and pipelines near riparian areas may disproportionately affect movements of large mammals other than caribou such as bears, moose, and muskoxen compared to similar infrastructure situated away from riparian areas. However, densities of these mammals are low and alterations of movements should be temporary.

Local and temporary obstruction of movements caused by roads and pipelines can be expected to be similar to that described for the ASDP, but construction of a more fully developed oilfield can create additional issues associated with larger-scale obstructions. Smith et al. (1994) reported that early in their study, large groups of insect-harassed caribou approached the central portion of the Kuparuk oilfield, but by the end of their study, large groups of caribou primarily approached only the edges of their study area, indicating that caribou avoided the center of activity.

Mortality

Accidental deaths from vehicle collisions should remain uncommon but would probably be proportionally greater by road length than in the CPAI Development Plan. Existing traffic restrictions and personnel training in existing oilfields mitigate occurrences of vehicle strikes in oilfields. Garbage control in the FFD should prevent increases in predator numbers that could potentially affect caribou and muskoxen. In Alternative A, local residents would have access to roads. If hunting were to be allowed from the road system, mortalities of terrestrial mammals in the FFD could increase. This could be managed by federal or state hunting regulations. During difficult winters, disturbance and displacement of muskoxen from riparian areas, overwintering caribou, or bears from dens could cause winter mortality or reduce calf survival in the spring.

Kalikpik-Kogru Rivers Facility Group

Direct Habitat Loss, Alteration, or Enhancement

The Kalikpik-Kogru Rivers Facility Group would have four production pads and one processing facility connected by pipelines and roads under FFD Alternative A (Figure 2.3.3.1-1). Some habitat would be lost under gravel, as described in the section about the CPAI Development Plan. However, the proportion of habitat that would be covered is small compared to that in the entire area. Terrestrial mammals would likely not experience serious range limitation as a result of gravel placement. In addition, habitat enhancement could occur, because caribou might use elevated gravel sites as insect-relief habitat. Effects of altered habitats would be the same for terrestrial mammals as described in the ASDP section but would occur over a larger area and over a longer period of time.

Disturbance and Displacement

Densities of calving caribou are expected to be greatest near the Special Caribou Stipulations Area in the northwest portion of the Kalikpik-Kogru Rivers Facility Group. This is particularly the case near prospective CD-28 and the processing facility APF-3, which are in the calving area of the TLH (BLM 1998a, 2003; Jensen and Noel 2002). Because of this, the BLM and MMS (1998b) outlined specific mitigation stipulations for development and operations in this area.

The access road and pipeline from APF-3 to CD-28, the pipeline from CD-28 to CD-29, and the air traffic at CD-29 may disturb calving caribou, but stringent stipulations limiting vehicle and air traffic would minimize disturbance. TLH caribou are not experienced with oilfields, and disturbance may be greatest during the first year of operations (Dau and Cameron 1986b).

Disturbance of caribou during summer and winter would occur locally as described previously in the CPAI Development Plan section, but potential impacts could be mitigated by controlling traffic and human activity.

Obstructions to Movement

Densities of caribou in all seasons have been high in the area of the Kalikpik and Kogru rivers compared to the other parts of the Plan Area (BLM 2003; Prichard et al. 2001). The roads/pipelines and facilities may impede movements during any time of the year, although as described previously for the CPAI Development Plan, caribou usually cross pipelines and roads like those designed for Alternative A. Moose and muskoxen are uncommon in this facility group area, so impacts to these species would be limited.

Mortality

Accidental deaths of terrestrial mammals from vehicle collisions in the Kalikpik-Kogru Rivers Facility Group would likely be uncommon if caution is taken. Existing traffic restrictions, including BLM stipulations and personnel training, mitigate vehicle collisions in oilfields. Like the CPAI Development Plan, development should have little or no impact on predator densities if garbage is managed properly and intentional feeding is prohibited, as required by BLM stipulations. In Alternative A, local residents would have access to roads. If hunting were allowed from the road system, mortalities could increase. During difficult winters, disturbance could have adverse effects on survival of overwintering caribou and muskoxen and on calf viability in the spring.

Alternative A – Summary of Impacts (CPAI and FFD) on Terrestrial Mammals

The CPAI Development Plan Alternative A would involve the changing of habitats used by terrestrial mammals in several ways. Two hundred seventy acres of undeveloped land would be covered with gravel fill and approximately 65 acres would be excavated to obtain the gravel. This is a small percentage of the land in the Plan Area. The amount of habitat types preferred by caribou, muskoxen, and moose that would be affected by this fill is a small proportion (less than 0.1 percent) of that available in the Plan Area. Alternative A would result in a small direct loss of terrestrial mammal habitat.

Construction and operations would cause some disturbance of terrestrial mammals. Disturbance could in turn displace mammals from preferred habitats. Noise and human activity associated with construction, industry vehicle traffic, aircraft traffic, and activity on facilities and pipeline routes during operations could disturb caribou, moose, muskoxen, and grizzly bears in the vicinity of infrastructure. This could cause animals to move away (be displaced) from infrastructure. Displacement is most likely early in the life of the project, because some habituation is likely over time. Disturbance of caribou (and probably also moose and muskoxen) is most likely for 2 to 3 weeks around the calving period in late May to early June. Because the CPAI Development Plan does not extend westward enough to include the primary calving areas of the TLH, as long as the calving range remains west of the development area, Alternative A would have little or no disturbance impact on calving caribou. During the summer post-calving period and winter, caribou are less sensitive to disturbance and would probably habituate to industry infrastructure and activity. However, access to the developed area by local residents may considerably increase the amount of disturbance to caribou, moose, muskoxen, and grizzly bears during summer and winter if hunting is allowed.

There would be 25.8 miles of road/pipeline and an additional 9.7 miles of pipeline without a road under CPAI Development Plan Alternative A. Pipelines would be elevated 5 feet and separated from roads by more than 300 feet. This should allow passage of caribou and other terrestrial mammals. The road/pipeline combination may delay or deflect caribou crossing, especially if traffic levels are more than 15 vehicles per hour. If local hunting occurs on the roads, crossing may be impeded because of increased avoidance of human activity.

Mortality of terrestrial mammals directly caused by the Alternative A development would probably be limited to occasional road kills and DLP killing of bears. Hunting by local residents on the oilfield roads would increase the mortality of caribou and possibly of moose, muskoxen, and grizzly bears.

All of the impacts described above are relevant to individual animals. It is unlikely these impacts would have a negative impact at the population level. The experience in existing North Slope oilfields shows that populations of terrestrial mammals (most notably caribou and grizzly bears) have grown or remained stable since initiation of development. The inclusion of local access to, and possibly hunting in, the Alternative A development could cause disturbance and mortality that affects the population. However, the past harvest levels of caribou, muskoxen, and moose by the local community are a small enough proportion of the populations that negative impacts are unlikely if proper mitigation and regulations are enforced. In fact, harvest is a primary tool of wildlife managers, for example, to keep a population at a level compatible with available habitat.

A positive aspect of increased hunter access is that it would allow more control over hunting harvest. Managers would have more ability to increase harvest when necessary.

Impacts from the Alternative A FFD would have the same effects described for the CPAI Development Plan, but over a larger area. An exception is the potential for increased disturbance of calving caribou of the TLH in the northwestern part of the Plan Area.

Alternative A – Potential Mitigation Measures (CPAI and FFD) for Terrestrial Mammals

Potential mitigation measures would be similar for the CPAI Development Plan Alternative A and the FFD Plan Alternative A.

Predators

1. Activities in the Plan Area, including hunting by local residents, would be coordinated among CPAI, the NSB, the State of Alaska, and federal agencies.

Herbivores

2. Pipelines should be elevated more than 5 feet to allow unimpeded crossings by caribou. Greater elevation (for example, 7 feet) could enhance crossing success in some cases (Eide et al. 1986; PAI 2002; Cronin et al. 1994).

3. Pipelines and roads with traffic should be separated by more than 300 feet where possible. This enhances caribou crossing success (PAI 2002; Curatolo and Reges 1986; Cronin et al. 1994). The success of animals trying to cross pipelines adjacent to roads with more than 5 vehicles per hour was reduced if the pipelines and roads were separated by less than 328 feet (100 meters) (Curatolo and Reges 1996). These results led to recommendations of separation of roads and pipelines by 400 to 500 feet for efficient crossing success (PAI 2002; Cronin et al. 1994).

4. Sections of pipeline can be buried to enhance crossing success of caribou, muskoxen, and moose. Caribou have shown selection of long, buried pipeline sections (average length 1.1 km) when crossing the trans-Alaska pipeline (Eide et al. 1986; Carruthers and Jakimchuk 1987; Cronin et al. 1994; TAPS Owners 2001). Moose did not show a preference for long buried sections. Neither caribou nor moose showed a preference for short (less than 18.3 meters) "sagbend" buried sections. Long buried sections of pipeline could be included in all four alternatives, but it may be most useful in Alternatives A and C, where there are long sections of pipeline/road combinations. Because the Plan Area is used by caribou in the winter, buried sections of pipeline may mitigate the potential barrier effect from snow drifting near pipelines in all of the alternatives. The observations of large numbers of caribou moving across the area of Fish and Judy creeks and across the Colville River Delta in the summer suggest placement of buried sections between CD-2 and CD-7 for Alternatives A and C might be appropriate. For Alternative C, buried sections between CD-1 and CD-3 could mitigate crossing the pipeline/road combination in that area. CPAI and management agencies should consult to determine if buried sections of pipeline are necessary and what specific locations and lengths of buried pipeline sections should be used.

5. Vehicle traffic can be restricted to groups of vehicles traveling in convoys, instead of unrestricted traffic. This may be appropriate during and immediately after calving periods in some areas, although it appeared that convoys were not particularly effective in reducing calving disturbance and displacement at the Meltwater Project, east of the Colville River (Lawhead et al. 2003). Restrictions of aircraft size and flight frequency and flight paths may also mitigate potential impacts on calving caribou, muskoxen, and moose. Currently, caribou calving is restricted to the western part of the Plan Area. If this range extends east or if the FFD proceeds to that area, such restrictions may be appropriate.

6. Potential impacts from research and monitoring also warrant consideration. Disturbance or mortality can result from surveys and capture activities (Bart 1977; Götmark 1992). Restricting research to that with practical management application can minimize this effect.

4A.3.4.2 Marine Mammals

Development activities within the Plan Area that could affect marine mammals include construction of roads, pads, airstrips, and pipelines; facility operation; and vehicle and aircraft traffic. Impacts from construction activities and during operations would be primarily from noise from vehicle and aircraft traffic. Noise propagation and measurement and the reactions of marine mammals to noise have been described previously (Richardson et al. 1995; USACE 1999; Richardson et al. 2002). Attractants for polar bears, such as garbage, may be generated by human activities during all phases of development. However, this would be mitigated with proper waste management. Ringed seals, bearded seals, and polar bears remain in the vicinity of the Plan Area during the winter months and might be present during construction of the project. During summer, beluga whales, spotted seals, and other marine mammals might also be present.

Oil spills also could directly or indirectly affect marine mammals in the Plan Area. Potential oil and chemical spills in the Plan Area are described in Section 4.4.

Alternative A – CPAI Development Plan Impacts on Marine Mammals

Ringed Seal and Bearded Seal

<u>Construction Period</u>

Habitat Loss, Alteration, or Enhancement. All roads, pads, airstrips, and pipelines would be constructed during the winter. None of the development infrastructure proposed under Alternative A is in or near ringed or bearded seal habitat, so there would be no impacts to those species.

Disturbance and Displacement. Neither aircraft nor vehicular traffic to any sites would affect ringed seals or bearded seals. Noise from vehicular traffic using an overland ice road to CD-3 or construction activity is not expected to propagate into seal habitat and would not affect seals.

Several round-trips per day by fixed-wing aircraft between Deadhorse-Prudhoe Bay and an airstrip at CD-1 or CD-3 would be a potential source of disturbance to seals hauled out on the ice in spring. Aircraft would be expected to maintain an elevation greater than 1,000 feet except upon takeoff and landing. At such elevations, the potential for disturbance to seals would be greatly reduced. Moulton et al. (2003) reported that there were no negative reactions to surveys flown at 300 feet, and only 1.5 percent of the observed seals dove into their holes in response to the aircraft. Other flights by fixed-wing aircraft or helicopters supporting construction could disturb or displace seals from their haulouts. The number of seals affected would depend on the frequency of flights over the Beaufort Sea seal habitat. Aircraft routes are not expected to pass over seal pupping habitat, so no impacts to seal pups are expected.

Obstructions to Movement. Construction of Alternative A facilities would not result in any obstruction to movements of ringed seals and bearded seals.

Mortality. Construction of the Alternative A facility would not result in any mortality to ringed seals and bearded seals except as the result of possible oil spills.

<u>Operation Period</u>

Habitat Loss, Alteration, or Enhancement. No ringed seal or bearded seal habitat alteration is expected, exception as a result of possible oil spills.

Disturbance and Displacement. Some disturbance and displacement of ringed seals and bearded seals during the operation period could occur from the noise of aircraft going to and from CD-1 and CD-3. Ringed seals follow the edge of the retreating pack-ice north during summer, so few ringed seals are expected to be in the Plan Area during summer. Those ringed seals that remain may be displaced for a short time by aircraft noise, but any effects are expected to be rare and of less than 1 hour duration. Flights that go over the ice edge could affect seals there. Breathing holes, lairs, and haulouts of ringed seals are often found away from lead edge habitat, so ringed seals could still be in flight paths even if planes avoided lead edge habitat. Maintaining a 1,000-foot minimum altitude would minimize effects on ringed seals at these sites.

Operation of production facilities is not expected to affect bearded seals, because noise from operations would not propagate into bearded seal habitat. Fixed-wing aircraft and helicopters could disturb a small number of bearded seals hauled out along shore and pack ice edges during the spring and summer. However, bearded seals generally prefer areas of less stable or broken sea ice (Cleator and Stirling 1990). Noise from airplanes or helicopters could displace bearded seals into the water for a short time. However, aircraft are expected to maintain elevations greater than 1,000 feet and are not expected to traverse lead edge habitat. Therefore, only a few bearded seals might be affected for short durations, annually. Maintaining flight paths away from lead edge habitat would mitigate impacts to bearded seals.

Obstructions to Movement. Alternative A operations would not result in any obstruction to ringed seal and bearded seal movements.

Mortality. Alternative A operations would not result in any direct mortality to ringed and bearded seals, except as the result of potential oil spills.

Spotted Seals

Spotted seals regularly use the main channel of the Colville River and Nigliq Channel in summer. Therefore, production activities on the Colville River Delta have greater potential to affect spotted seals than ringed seals or bearded seals. Johnson et al. (1998, 1999) found spotted seals only in the East Channel of the Colville River, at the mouth of the Kachemach River, and on the southwest end of Anachlik Island. Local residents of Nuiqsut report that spotted seals regularly use Nigliq Channel and the Fish and Judy creek deltas (Morris 2003, pers. comm.). Spotted seals have been observed as far upstream as Ocean Point and occur regularly as far as the mouth of the Itkillik River (Reed 1956; Seaman et al. 1981).

Construction Period

Habitat Loss, Alteration, or Enhancement. Alternative A includes construction of a 1,200-foot-long bridge across the Nigliq Channel to connect NPR-A sites CD-5, CD-6, and CD-7 to CD-2. The bridge across Nigliq Channel has the potential to alter spotted seal haulout habitat on gravel or sand bars in the river through changes in the flow of the river that could change the deposition of sand within the channel. The number of spotted seals affected would depend on the amount of habitat alteration that occurs and the number of seals using the area. The severity of the disturbance depends on the proximity of other suitable haulouts. However, effects to individual seals are likely to be short duration (less than 1 year) and are not expected to result in injury to any spotted seals.

Disturbance and Displacement. Because spotted seals are present in the Plan Area only during the summer, winter construction activities would not disturb or displace spotted seals. However, spring or summer construction in the vicinity of the rivers could disturb spotted seals. The extent of displacement would vary depending on the type of construction activity, the behavior and activity state of the seals, the proximity of the seals to the construction activity, and other known and unknown factors.

Obstructions to Movement. Because spotted seals are present in the Plan Area only during the summer, winter construction activities would not obstruct spotted seal movements. However, spring or summer construc tion could block movements of seals up and down the rivers. The extent of obstruction would vary depending on the type of construction activity, the behavior and activity state of the seals, the proximity of the seals to the construction activity, and other known and unknown factors.

Mortality. Because spotted seals are present in the Plan Area only during the summer, winter construction activities would not cause any spotted seal mortality. With the exception of the results of possible oil spills, spring or summer construction would not cause mortality.

Operation Period

Habitat Loss, Alteration, or Enhancement. The construction of bridges could alter habitats as described above. No additional habitat alterations are expected during operations, with the exception the results of possible oil spills.

Disturbance and Displacement. Vehicle traffic across the bridge over Nigliq Channel could disturb spotted seals hauled out on sand or gravel banks nearby. Noise from vehicle traffic could displace a small number of seals from haulouts on sand or gravel bars near bridges. However, a large volume of traffic on the roads during operations is not anticipated. The number of seals affected would depend on the proximity of the bridge to any haulouts, and the number of seals on the haulouts. Impacts to individual seals are expected to be short-term and are not expected to result in injury to any spotted seals.

Aircraft traffic in the Plan Area is also a potential source of disturbance to spotted seals hauled out on sand or gravel bars during the summer. The approach trajectories for aircraft include a path directly over Nigliq Channel, and planes may approach across the main channel coming to or from Deadhorse. Overflights by fixed-wing aircraft could cause the temporary displacement of seals from the haulouts. Aircraft are expected to maintain an elevation greater than 1,000 feet except during takeoff and landing. At 1,000 feet, the potential for disturbance to seals is greatly reduced. Johnson et al. (1998) reported no reaction of seals to surveys flown at altitudes of 255 to 705 feet but reported reactions (seals entering water) when the plane circled the haulouts at those altitudes. However, when aircraft are at low altitude during takeoff and for landing, the potential for disturbance increases. The number of seals affected would depend on the number of takeoffs and landings and the number of seals on the haulouts. Displacement of hauled out seals is not likely to result in injury to any seals, and they could habituate to the noise.

Obstructions to Movement. Facility operations in Alternative A are not expected to obstruct movements of spotted seals. It is possible that seals will hesitate before crossing under bridges.

Mortality. Alternative A operations are not expected to cause any mortality of spotted seals, except as the result of possible oil spills. If access for hunters increases, mortality could increase.

Polar Bears

Polar bears are present in the Plan Area throughout the year. Males and non-pregnant females may be active on the ice and onshore throughout the year, while pregnant females could den in the Plan Area.

Construction Period

Habitat Loss and Alteration. Parts of the Plan Area are polar bear habitat; some polar bear denning habitat may be lost as a result of construction activities. Stipulations require that construction activities under Alternative A not occur within 1 mile of known or suspected polar bear dens. Adhering to this stipulation could reduce loss of habitat.

Disturbance and Displacement. Construction of roads, pads, and pipelines is a potential source of disturbance for polar bears in the Plan Area. Female polar bears denning within approximately 1 mile of the construction activity could be disturbed by vehicular traffic or construction noise. Disturbance of females in maternity dens could result in either abandonment of the cubs or premature exposure of cubs to the elements, resulting in mortality (Amstrup 1993). Few dens have been located in the Plan Area in the last 10 years, although bears are known to occasionally den in the area (USFWS, unpublished data). Regulations require that road and other construction activities maintain a 1-mile buffer around known or suspected polar bear dens. MacGillivray et al. (2003) measured noise from industrial activities in artificial dens at varying distances from the activity. Noise in the dens from vehicular traffic was generally at background levels when vehicles were approximately 500 meters away. However, one vehicle was detectable above background levels at a distance of 2,000 meters. Thus, it appears that current regulations would prevent disturbance to polar bears in natal dens that are known. Other bears could be disturbed by the construction of roads, pads, or pipelines. The number of bears affected would depend on the number of dens that are undetected but within a 1-mile buffer around construction activity. The severity of the effect would depend on the reaction of individual bears, whether the den is abandoned, and the age of the cubs when the disturbance occurs.

Aircraft traffic to and from the Plan Area could also disturb polar bears. MacGillivray et al. (2003) reported that helicopters were the loudest vehicles recorded during their study, and that sound was only minimally attenuated by distance and through the snowpack. Fixed-wing aircraft also can disturb denning bears. The number of bears affected would depend on the number of polar bear dens in flight paths. As with other noise impacts, the severity of effects would depend on the reaction of individual bears, whether the den is abandoned, and the age of the cubs.

Aircraft traffic may also disturb non-denning polar bears in the Plan Area. Non-denning polar bears often react to low-flying aircraft by running away. Helicopters are sometimes used to scare bears away from human habitation (Richardson et al. 1995). The number of bears affected would depend on the number of bears that are near aircraft flightpaths. Effects would be limited to displacement for a short time.

Non-denning polar bears may avoid the immediate vicinity of construction activities or they may be attracted to it, depending on the circumstances and temperament of individual bears. Avoidance of the area would reduce the potential number of human-bear interactions, thereby reducing the potential for injury to people or the need to kill bears. Attraction to the area would increase the potential for human-bear interactions, and may result in the death of the bear in defense of human life or property. However, such actions have been rare (Federal Register 68(143)44028); only two polar bear deaths related to oil and gas have occurred in the past, and such deaths are not expected to be common in the Plan Area. Training of oilfield workers and regulations such as those already in place for other arctic developments would be helpful in minimizing bear-human conflicts. Thus, interactions between humans and bears are expected to be few and of short duration.

Obstructions to Movement. No obstructions to polar bear movement are expected as a result of CPAI Development Plan Alternative A construction.

Mortality. No polar bear mortality is expected as a result of Alternative A construction. However, human-bear conflict, oil spills, or increased hunting access could result in mortality.

<u>Operation Period</u>

Habitat Loss, Alteration, and Enhancement. The facilities for Alternative A could cover potential denning habitat. However, denning habitats are likely available in the Plan Area and adjacent areas. Bears have denned on inactive gravel pads, so new den sites could be available in the future.

Disturbance and Displacement. In general, potential impacts to polar bears during the operation period are similar to those described for construction. These impacts would be primarily from noise from vehicles, facilities, and aircraft. Some denning bears could be disturbed if noise levels increase after den initiation. Polar bears in the Beaufort Sea seldom venture onto land (Amstrup 2000) and are unlikely to be found in the Plan Area during summer. They are therefore unlikely to be affected by operations activities that occur during the summer.

Obstructions to Movement. No obstructions to polar bear movement are expected as a result of operations under Alternative A.

Mortality. No polar bear mortality is expected as a result of operations under Alternative A. However, human-bear conflict, oil spills, or increased hunting access could result in mortality.

Beluga Whales

Beluga whales could be present offshore of the Plan Area in low numbers during the summer. Belugas pass near the Plan Area during their fall migration from the eastern Beaufort Sea to their wintering grounds in the Bering Sea, but few probably pass through Harrison Bay. Treacy (1988-2002) detected small numbers of belugas in Harrison Bay during aerial surveys conducted during the fall bowhead whale migration. Most belugas pass north of a line from Cape Halkett to Oliktok Point during migration. During the spring migration, nearshore waters are ice-covered and belugas stay far offshore of Harrison Bay in the lead system.

Construction Period

Habitat Loss, Alteration, or Enhancement. Construction of the bridge over the Nigliq Channel would modify habitat at that site. Construction activities at that site would not affect beluga whales, because construction activities would take place during the winter when belugas are not present in the Plan Area. Potential effects of the bridge during the operations phase of the project are discussed below.

Disturbance and Displacement. Beluga habitat is primarily in the Beaufort Sea, and no impacts from construction are expected there with the exception of possible oil spills. Construction of the bridge over the Nigliq Channel could change stream conditions and affect the few belugas that go there.

Obstructions to Movement. Construction of facilities under Alternative A would not obstruct movements of beluga whales.

Mortality. Construction of facilities under CPAI Development Plan Alternative A would not cause beluga whale mortality except as the result of possible oil spills.

Operation Period

Habitat Loss, Alteration, or Enhancement. The 1,200-foot bridge over the Nigliq Channel of the Colville River has the potential to affect beluga whales in the Nigliq Channel. Nuiqsut residents report that belugas occur in the Nigliq channel and main channel of the Colville River and in the Fish Creek Delta (Morris 2003, pers. comm.). Bridge supports within the Nigliq Channel, if they alter streamflow and deposition of sand or gravel in the channel, could affect the ability of the belugas to navigate the channel. The number of belugas affected would depend on the number of whales that enter Nigliq Channel.

Disturbance and Displacement. Operations during the summer would not affect belugas in the Beaufort Sea, because noise from facilities is not expected to propagate there. Vehicle traffic over the Nigliq Channel bridge may create noise that could affect belugas near the bridge. Such impacts are expected to be short term, short distance displacement and are not expected to result in injury to any whales. Aircraft traffic over the Nigliq Channel could potentially affect beluga whales in the Plan Area. Beluga whales respond to aircraft differently depending on the context of their social group, environmental conditions, and aircraft altitude (Richardson et al. 1995). Feeding groups of belugas appeared to be less prone to disturbance by an aircraft at 1,640 feet altitude than are lone animals (Bel'kovich 1960, in Richardson et al. 1995). Inupiat hunters suspected that low-flying aircraft were responsible for preventing belugas from entering a bay along the Alaskan Beaufort Sea coast (Burns and Seaman 1985). The number of whales that might be affected would depend on the number of whales using Nigliq Channel. There are no estimates of the number of whales using Nigliq Channel. Reports indicate belugas commonly occurred near the shorefast ice in the Delta region until ice moved offshore (Hel mericks, pers. comm., cited in Hazard 1988). The severity of the effect would depend on the conditions described above, but impacts are expected to be short-term and are not expected to result in injury to any whale.

Obstructions to Movement. No obstructions to beluga whale movements are expected as a result of facility operations under CPAI Development Plan Alternative A. It is possible that activity on the Nigliq Channel bridge would delay belugas, but few probably go up the channel.

Mortality. No beluga whale mortality is expected as a result of operations under Alternative A, with the exception of that caused by possible oil spills and increased hunter access.

Alternative A – Full-Field Development Plan Impacts on Marine Mammals

The FFD Alternative A sites with the most potential to affect marine mammals are hypothetical pads CD-11, CD-12, CD-14, CD-15, CD-18, CD-19, CD-20, and CD-21 in the Colville River Delta; CD-8, CD-10, and CD-22 in the Fish-Judy Creeks Facility Group; and CD-28 and CD-29 in the Kalikpik-Kogru Rivers Facility Group.

Colville River Delta Facility Group

Facilities in the river deltas have the potential to affect ringed seals, spotted seals, and beluga whales. Noise from construction of roads and facilities and aircraft traffic along the coast during the winter has the potential to disturb ringed seals. Construction and operations, and aircraft traffic during the summer, have the potential to displace spotted seals and beluga whales from river habitats. CD-12 is directly adjacent to the Nigliq Channel, and CD-11, CD-14, CD-15, CD-19, and CD-21 are adjacent the main channel of the Colville River. Roads are planned to CD-11 and CD-12. Aircraft would serve the other pads.

Construction, operation, and aircraft and ground vehicle traffic have the potential to disturb denning and non-denning polar bears. Denning polar bears within approximately 1 mile of roads could be disturbed. Denning and non-denning polar bears could also be disturbed by aircraft traffic. Bears could also be displaced from, or drawn to, construction activities, depending on individual bears' reactions. Impacts to denning bears could result in abandonment or early emergence of cubs. Impacts to non-denning bears could range from displacement to death if a bear threatens human life or property, is struck by a vehicle, or encounters a toxic substance. Mitigation measures already in place for other arctic developments would minimize these impacts. Increased hunter access may result in more mortality of polar bears and seals.

Fish-Judy Creeks Facility Group

CD-10 and CD-22 lie within the delta of Fish and Judy creeks, and roads would run to them. Local hunters from Nuiqsut identified Fish and Judy creeks as spotted seal and beluga habitat. Construction and operations activities and aircraft traffic to and from these sites may displace some spotted seals and beluga whales. The number of seals and whales affected would depend on the numbers that are present in the area. Disturbance would generally be short-term. Impacts to polar bears in this area would be similar to those described above for the Colville River Delta Facility Group. Disturbance of polar bears (including dens) is less likely the farther inland the sites would be.

Kalikpik-Kogru Rivers Facility Group

CD-28 and CD-29 are adjacent to the Kogru River, which is also potential spotted seal and beluga whale habitat. Construction and operation activities and aircraft traffic to and from the sites may disturb some spotted seals and beluga whales. Disturbance would generally be short-term. Impacts to polar bears would be similar to those described above for the Colville River Delta Facility Group. Disturbance of polar bears is less likely the farther inland the sites are.

Alternative A – Summary of Impacts (CPAI and FFD) on Marine Mammals

There would be limited impacts on marine mammals from the CPAI Development Plan because the project is onshore. Construction of, and traffic on, a bridge over the Nigliq Channel and other rivers could cause some disturbance of spotted seals and beluga whales. Aircraft traffic to and from the Plan Area could also disturb some marine mammals. Construction and operational noise in winter could disturb some denning polar bears.

Access by local residents could increase harvest of marine mammals, including seals in the rivers and near-shore Beaufort Sea. Hunting by local residents on the oilfield roads could increase the mortality of polar bears that are onshore. Mortality of polar bears directly caused by the Alternative A development could include occasional road kills and killing of bears in defense of life and property.

All of the impacts described above are relevant to individual animals. It is unlikely these impacts would have a negative effect at the population level. The experience in existing North Slope oilfields shows that populations of marine mammals have not been affected by onshore development. The inclusion of local access to, and possibly hunting in, the Alternative A development may cause disturbance and mortality that affect marine mammal populations. However, the past harvest levels of seals and polar bears by the local community are a small enough proportion of the populations that negative impacts are unlikely if proper mitigation and regulations are enforced. In fact, harvest is a primary tool of wildlife managers, for example, to keep a population at a level compatible with available habitat. A positive aspect of increased hunter access is that it would allow more control over hunting harvest. Managers would have more ability to increase harvest when necessary.

Impacts from Alternative A FFD would have the same effects described for the CPAI Development Plan but over a larger area.

Alternative A – Potential Mitigation Measures (CPAI and FFD) for Marine Mammals

Potential mitigation measures would be similar for the CPAI Development Plan Alternative A and the FFD Plan Alternative A.

1. Aircraft altitude restrictions over rivers and the nearshore Beaufort Sea during periods when marine mammals are present.

2. Surveys for polar bear dens prior to construction of ice roads or permanent roads and facilities would allow avoidance of the dens by 1 mile.

3. For Alternatives A and C, activities in the Plan Area including hunting by local residents, would be coordinated among CPAI, the NSB, the State of Alaska, and federal agencies.

4A.3.5 Threatened and Endangered Species

4A.3.5.1 Bowhead Whale

Alternative A – CPAI Development Plan Impacts on Bowhead Whales

Bowhead whales are not found in the Plan Area. During spring migration, bowheads are far offshore in the lead system of the Beaufort Sea. During fall migration, most bowheads pass north of a line from Cape Halkett to Oliktok Point. For a discussion of the impacts of oil spills and the likelihood of a large spill during fall migration, see Section 4.3. Otherwise, Alternative A construction and operations would not affect the bowhead whale population, habitat, migration, foraging, breeding, survival and mortality, or critical habitat.

Alternative A – Full-Field Development Plan Impacts on Bowhead Whales

The only impacts to bowheads under FFD could be from ships used to transport equipment through the Beaufort Sea to the Plan Area. In this case, bowheads could be affected by noise, fuel spills, and vessel strikes. However, the use of docks was determined not to be a practical means of developing the facilities proposed by CPAI or during future development, so the probability of vessel traffic would be low.

Alternative A – Summary of Impacts (CPAI and FFD) on Bowhead Whales

Bowhead whales generally do not occur in the nearshore Beaufort Sea north of the Plan Area. During spring and fall migrations, bowheads are far offshore in the lead system of the Beaufort Sea. If some whales do come into the nearshore environment, there could be some disturbance of bowheads from air traffic over the Beaufort Sea. However, altitude restrictions would minimize these impacts. Other activities that would occur in the Plan Area under all alternatives would not affect the bowhead whale population, habitat, migration, foraging, breeding, survival and mortality, or critical habitat.

In general, impacts from the FFD Alternative A would be the same as those described for the CPAI Development Plan over a larger area. Under the FFD, sealifts may be used to transport drilling or processing facilities. In this case, there is the potential for additional impacts to bowhead whales from vessels. Impacts to bowheads could result from noise, pollution, and vessel strikes. However, the use of docks was determined not to be a practical means of developing the facilities proposed by CPAI or during future development, so this impact may not be realized.

Alternative A –Potential Mitigation Measures (CPAI and FFD) for Bowhead Whales

Potential mitigation measures to reduce impacts to bowhead whales could include aircraft altitude restrictions over the nearshore Beaufort Sea during periods when whales could be present (spring, summer, fall). In the event of sealifts to transport material to the FFD sites, measures to minimize disturbance of, or strikes to, migrating whales by vessels are appropriate and would require coordination with NOAA Fisheries for compliance with the Marine Mammal Protection Act.

4A.3.5.2 Spectacled Eider

Alternative A – CPAI Development Plan Impacts on Spectacled Eider

This section describes the potential impacts of the ASDP on threatened spectacled eiders. Impacts to other bird groups associated with the proposed development are described in Section 4A.3.3 and can be referred to for more detailed description of specific impacts.

Spectacled eiders in the Colville River Delta are associated with coastal areas averaging about 4.0 km from the coast and within 14.3 km of the coast. Of the proposed pad sites, CD-3 has the highest concentration of spectacled eiders and is the area where impacts to spectacled eiders are likely to be greatest. The outer Colville River Delta has an average density of 0.21 spectacled eiders/km^2 during pre-nesting (n = 9 years; Johnson et al. 2003b). Spectacled eiders are less common in the CD-4 area (less than 0.01 birds per square kilometer during pre-nesting) than in the CD-3 area (Burgess et al. 2003a; Johnson et al. 2003b). The potential impacts of gravel placement at CD-4 would likely affect fewer spectacled eiders than would be affected at the CD-3 site. Spectacled eiders are also less common in the general area of the sites proposed for development in the eastern NPR-A compared to the northern portion of the Colville River Delta (Burgess et al. 2003b). The density of spectacled eiders during pre-nesting has ranged from 0.02 to 0.09 birds/km^2 (Anderson and Johnson 1999; Murphy and Stickney 2000; Burgess et al. 2003b).

Construction Period

Habitat Loss, Alteration, or Enhancement

Winter placement of gravel during construction would account for most of the direct habitat lost or altered by the proposed development. Tundra covered by gravel would be unavailable for spectacled eider nesting, brood-rearing, and foraging habitat. A summary of habitats lost due to gravel fill and altered by dust outfall or gravel spray by CPAI Development Plan Alternatives in the Colville River Delta and the NPR-A with habitat use by spectacled eiders is presented in Tables 4A.3.5-1 and 4A.3.5-2. One spectacled eider nest would potentially be affected by this habitat loss based on nesting densities in the CD-3 area and in the NPR-A. In all cases, less than 1 percent of habitats used for nesting by spectacled eiders in the Colville River Delta and the NPR-A portions of the Plan Area would be covered by gravel (Table 4A.3.5-1 and Table 4A.3.5-2).

Dust deposition can affect eider habitat by causing early green-up on tundra adjacent to roads and pads that could attract spectacled eiders and other waterfowl early in the season when other areas are not yet snow free. Dust deposition can also increase thermokarst and soil pH and reduce the photosynthetic capabilities of plants in areas adjacent to roads (Walker and Everett 1987; Auerbach et al. 1997). Traffic levels, air traffic (including helicopters), and wind can all influence the amount of dust that might be deposited adjacent to roads and pads.

Temporary loss of habitat associated with gravel placement would occur on tundra adjacent to gravel structures where accumulated snow from snow plowing activities or snowdrifts becomes compacted and causes delayed snowmelt. Delayed snowmelt that persists into the nesting season would preclude eiders from nesting in those areas. Delayed snowmelt resulting from the construction and use of ice roads during winter activities would also cause temporary habitat loss. Less than one spectacled eider nest would potentially be affected by this temporary habitat alteration. Ice roads would be expected to cover habitats similar to gravel placement in the project area and would not be expected to affect a significant proportion of the available preferred or used pre-nesting, nesting, or brood-rearing habitats within the Colville River Delta or within the NPR-A portion of the Plan Area.

Ponding created by gravel structures, ice roads, or snowdrifts could become permanent water bodies that persist from year to year or they might be ephemeral and dry up early during the summer (Walker et al. 1987; Walker 1996). Ponding could create new feeding and brood-rearing habitat that might be used by some bird species (Kertell 1993, 1994). Placement and maintenance of culverts in roadways eliminates or mitigates the formation of ponding. The proposed gravel mine site would add aquatic habitat that might be suitable for use by waterfowl.

TABLE 4A.3.5-1 CPAI ALTERNATIVES A-D – SUMMARY OF AFFECTED HABITAT TYPES IN THE COLVILLE RIVER DELTA USED BY SPECTACLED EIDERS[a]

Habitat Type	Colville River Delta											
	Acres in Colville River Delta[b]	Alternative A Loss or Alteration[c] (Acres and %)		Alternative B Loss or Alteration[c] (Acres and %)		Alternative C Loss or Alteration[c] (Acres and %)		Alternative D Loss or Alteration[c] (Acres and %)		Spectacled Eider		
										Pre-Nesting	Nesting	Brood-Rearing
Open Nearshore Water	2,476											
Brackish Water	1,614										use	
Tapped Lake with Low-water Connection	5,342					21	(0.4%)			prefer		
Tapped Lake with High-water Connection	5,132	12	(0.2%)	12	(0.2%)	12	(0.2%)					
Salt Marsh	4,090					5	(0.1%)			prefer		
Tidal Flat	13,841									avoid		
Salt-killed Tundra	6,336									prefer	use	use
Deep Open Water without Islands	5,132					1	(0.0%)					use
Deep Open Water with Islands or Polygonized Margins	191,756	8	(0.0%)	8	(0.0%)	11	(0.0%)	2	(0.0%)			use
Shallow Open Water without Islands	499	1	(0.2%)			1	(0.2%)					
Shallow Open Water with Island or Polygonized Margins	133									prefer		
River or Stream	20,280	2	(0.0%)			8	(0.0%)			avoid		
Aquatic Sedge Marsh	32											
Aquatic Sedge with Deep Polygons	3,267	8	(0.2%)	8	(0.2%)	2	(0.1%)	8	(0.2%)	prefer	use	use
Aquatic Grass Marsh	358	9	(2.4%)	9	(2.4%)	9	(2.5%)					
Young Basin Wetland Complex												
Old Basin Wetland Complex	2		(0.0%)									
Riverine Complex												
Dune Complex												
Nonpatterned Wet Meadow	10,265	26	(0.3%)	17	(0.2%)	22	(0.2%)	23	(0.2%)		use	
Patterned Wet Meadow	25,361	54	(0.2%)	40	(0.2%)	119	(0.5%)	94	(0.4%)	avoid	use	use
Moist Sedge-Shrub Meadow	3,262	18	(0.6%)	18	(0.6%)	29	(0.9%)	1	(0.0%)	avoid		
Moist Tussock Tundra	630											
Riverine Low and Tall Shrub						3						
Upland Low and Tall Shrub												
Upland and Riverine Dwarf Shrub[b]												
Riverine or Upland Shrub[c]	6,815	4	(0.1%)	1	(0.0%)	13	(0.2%)	4	(0.1%)	avoid		
Barrens (riverine, eolian, or lacustrine)	19,440	7	(0.0%)	4	(0.0%)	11	(0.1%)			avoid		
Artificial (water, fill, peat road)	96											
Total Area	136,323	149	(0.1%)	118	(0.1%)	264	(0.2%)	134	(0.1%)			

Notes:

a Selection or use (>10% of observations) of habitats by life history stage (Johnson et al. 2003a).

b Mapped for Colville River Delta area only.

c Total includes gravel for pads and airstrips and area affected by dust.

TABLE 4A.3.5-2 CPAI ALTERNATIVES A-D – SUMMARY OF AFFECTED HABITAT TYPES IN THE NPR-A USED BY SPECTACLED EIDERS[a]

Habitat Type	Acres in NPR-A[b]	Alternative A Loss or Alteration[c] (Acres and %)		Alternative B Loss or Alteration[c] (Acres and %)		Alternative C Loss or Alteration[c] (Acres and %)		Alternative D Loss or Alteration[c] (Acres and %)		Pre-Nesting	Nesting	Brood-Rearing
Open Nearshore Water	840											
Brackish Water	331											
Tapped Lake with Low-water Connection	420											
Tapped Lake with High-water Connection	17											
Salt Marsh	902											
Tidal Flat	2,021											
Salt-killed Tundra	35											
Deep Open Water without Islands	12,343					3	(0.0%)					
Deep Open Water with Islands or Polygonized Margins	8,950											
Shallow Open Water without Islands	1,737			3	(0.2%)	2	(0.1%)					
Shallow Open Water with Island or Polygonized Margins	2,824	0	(0.0%)	3	(0.1%)	1	(0.0%)			prefer	use	
River or Stream	1,525	0	(0.0%)									
Aquatic Sedge Marsh	2,854	2	(0.1%)	9	(0.3%)	6	(0.2%)	5	(0.2%)			
Aquatic Sedge with Deep Polygons	74											
Aquatic Grass Marsh	487											
Young Basin Wetland Complex	623	9	(1.4%)	7	(1.2%)	9	(1.5%)	10	(1.5%)			
Old Basin Wetland Complex	15,118	14	(0.1%)	11	(0.1%)	33	(0.2%)			prefer	use	
Riverine Complex	687	1	(0.2%)			1	(0.1%)					
Dune Complex	1,876											
Nonpatterned Wet Meadow	5,305	11	(0.2%)	15	(0.3%)	15	(0.3%)	20	(0.4%)			
Patterned Wet Meadow	19,487	41	(0.2%)	21	(0.1%)	47	(0.2%)	24	(0.1%)		use	
Moist Sedge-Shrub Meadow	39,920	83	(0.2%)	76	(0.2%)	144	(0.4%)	25	(0.1%)			
Moist Tussock Tundra	47,101	209	(0.4%)	61	(0.1%)	226	(0.5%)	55	(0.1%)	avoid		
Riverine Low and Tall Shrub	1,794	1	(0.0%)									
Upland Low and Tall Shrub	692											
Upland and Riverine Dwarf Shrub[d]	2,217											
Riverine or Upland Shrub[c]	0											
Barrens (riverine, eolian, or lacustrine)	1,690											
Artificial (water, fill, peat road)	0											
Total Area	**171,869**	**370**	**(0.2%)**	**206**	**(0.1%)**	**488**	**(0.3%)**	**139**	**(0.1%)**			

Notes:

a Selection or use (>10% of observations) of habitats by life history stage (Burgess et al. 2003b).

b Mapped for NPR-A area only.

c Total includes gravel for pads and airstrips and area affected by dust.

d. Mapped for Colville River Delta area only.

Spectacled eider nests average less than 4 meters from lake shorelines in the CD-3 area (Johnson et al. 2003a), and water withdrawal from lakes during ice-road construction could lower the level of lakes and influence spectacled eider nesting habitat. Changes in the surface levels of lakes from water withdrawals depend on the amount of water withdrawn, the size of the lake, and the recharge rate. Water withdrawal from permitted water sources for the construction of ice roads likely would not affect nesting habitat because of State of Alaska permitting restrictions regulating the volume of water that may be withdrawn from each lake and because of the recharge of ponds and wetlands by snowmelt runoff in spring (Rovansek et al. 1996; Burgess et al. 2003b; Baker 2002).

Disturbance and Displacement

Because gravel placement would be conducted during the winter when spectacled eiders do not occur on the Arctic Coastal Plain, no spectacled eider nests would be disturbed or displaced by this activity. Some spectacled eiders would be disturbed during the summer breeding season by vehicle, aircraft, and boat traffic; noise from equipment on roads; noise from facilities; and pedestrian traffic. Disturbance by vehicles, equipment activities such as road grading and compaction, or aircraft during summer would decrease the numbers of spectacled eiders nesting, brood-rearing, or foraging adjacent to roadways (Ward and Stehn 1989; Murphy and Anderson 1993; Johnson et al. 2003b).

Noise and visual stimuli associated with helicopter and fixed-wing air traffic would disturb spectacled eiders near the proposed airstrip at the CD-3 site. Responses of birds to aircraft include alert postures, interruption of foraging behavior, and flight. Such disturbances may displace birds from feeding habitats and negatively impact energy budgets. The potential for noise associated with aircraft to have negative impacts on birds is probably greatest during the nesting period when movements of incubating birds are restricted. The highest aircraft noise levels occur during takeoff as engines reach maximum power levels. During landings, aircraft noise levels are reduced as engine power decreases. Studies at Alpine indicate that disturbance during heavy construction would result in displacement of up to 50 percent of nesting waterfowl within 500 meters of the airstrip (Johnson et al. 2003b). On the basis of spectacled eider nesting density in the CD-3 area, this disturbance would result in the potential displacement of one spectacled eider nest.

Anderson et al. (1992) reported that during the nesting period, spectacled eiders near the GHX-1 facility in the Prudhoe Bay area appeared to adjust their use of the area to locations farther from the facility in response to noise. Spectacled eiders nesting near the proposed airstrip at the CD-3 site might be similarly affected and might relocate nest sites to suitable habitats farther from the airstrip in response to noise and movements from vehicular traffic and machinery and from air traffic.

Obstructions to Movement

In general, the infrastructure associated with Alternative A, including roads and production pads, the airstrip, buildings, elevated pipelines, and bridges, would not be major obstructions to movements of spectacled eiders. These birds can fly and can easily move over or around these structures. These structures may present some temporary obstructions during brood-rearing and molting periods when birds are flightless, particularly if traffic levels are high (Murphy and Anderson 1993). However, TERA (1996) reported that spectacled eider broods did not avoid facilities, crossed roads, and were found in or moved to high noise areas such as gathering centers and the Deadhorse airport.

Mortality

Other than potential oil spill-related mortality (see Section 4.3), there likely would be little spectacled eider mortality related to the development under Alternative A. Some spectacled eider mortality would result from collisions with vehicular traffic, although roads in Alternative A are located in areas with very low spectacled eider density. Reduced speed limits along roads, particularly during periods of poor visibility, may help to reduce the potential for bird collisions with vehicles. Some mortality of a few individuals would be associated with birds that collide with structures such as power lines, pipelines, buildings, or bridges, although collisions would be infrequent (Murphy and Anderson 1993). Mortality of a few individuals would be associated with collisions with aircraft during takeoff or landing. Collisions with aircraft are the most likely source of mortality with the location of the airstrip at CD-3, in an area with the highest nesting density of spectacled eiders in the Project Area. Effects of mortality from aircraft collisions could be mitigated by hazing of birds away from active airstrips.

Predators, such as ravens, gulls, arctic fox, and bears may be attracted to areas of human activity where they find anthropogenic sources of food and denning or nesting sites (Eberhardt et al. 1982; Day 1998; Burgess 2000). Increased levels of depredation due to elevated numbers of predators could impact nesting and brood-rearing spectacled eiders. The numbers of foxes and most avian predators at the existing Alpine Development did not appear to increase during construction of the project with the exception of common ravens, which nested on buildings at the Alpine site (Johnson et al. 2003b). Installation of predator-proof dumpsters at camps and improved refuse handling techniques minimize the attraction of predators to landfills. Oilfield workers undergo training to make them aware of the problems associated with feeding wildlife. These practices have helped to mitigate the potential impacts related to increased levels of depredation and would be continued in the ongoing development of the Alpine Project.

Researchers conducting studies on avian nest density and success may inadvertently affect nesting success by attracting predators to nests and broods (Bart 1977; Götmark 1992; Strang 1980). Birds that are flushed from their nests during surveys are more susceptible to nest depredation than are undisturbed birds. Ongoing activities by researchers could cause some mortality to spectacled eider eggs and chicks. Care should be taken by researchers to minimize research-related impacts that may occur, particularly from activities that flush incubating eiders from nests.

Operation Period

Habitat Loss, Alteration, or Enhancement

Spectacled eider habitat loss and alteration from snow drifts, gravel spray, dust fallout, thermokarst, and ponding would continue during project operation. Habitat alterations could include compaction by low-ground-pressure vehicles during summer or winter; these changes are unlikely to affect spectacled eiders.

Disturbance and Displacement

Disturbance and displacement from aircraft and vehicle traffic and facility noise would be similar to the construction phase. Disturbance would be reduced from the construction phase because of reduced levels of both air and ground traffic. Disturbance types along with the general reactions of spectacled eiders are discussed under the construction period.

Boat traffic during oil spill drills, equipment checks, and boom deployment, especially airboat traffic, could be disruptive to pre-nesting, nesting, foraging, and brood-rearing spectacled eiders. Spectacled eiders did not appear to use riverine habitats during pre-nesting, nesting or brood-rearing in either the Colville River Delta or NPR-A sites proposed for development and would not likely be displaced by these activities.

Obstructions to Movement

Obstructions to movements from roadways would continue during project operations and would be similar to project construction. Obstructions would be reduced from construction because of reduced traffic levels.

Mortality

Some spectacled eider mortality would result from collisions with aircraft, vehicles, elevated pipelines, buildings, power lines, or bridges, particularly under poor visibility conditions. Collisions would be limited to a few individuals, and frequency would be reduced during operations compared to during construction because of reduced traffic levels.

Alternative A – Full-Field Development Plan Impacts on Spectacled Eider

Under the Alternative A scenario for FFD, the mechanisms associated with impacts related to habitat loss and alteration, disturbance and displacement, obstruction to movements, and mortality for birds in the Colville River Delta, Fish-Judy Creeks, and Kalikpik-Kogru Rivers Facility Groups would be the same as those described under Alternative A for the ASDP. Under Alternative A FFD, roads would link all production pads, except for four pads in the lower Colville River Delta and one pad in the Kalikpik-Kogru Rivers area (CD-29), to processing facilities and to the existing Alpine facilities. Airstrips would be constructed at these production pads in the lower Colville River Delta and the Kalikpik-Kogru Rivers areas for maintenance and operational support. Development in the three areas would be in addition to the development proposed under Alternative A of the ASDP, and the potential impacts described below would be in addition to those described under Alternative A for the ASDP. The effects of FFD on spectacled eiders would depend on the location and extent of development within each area. Table 4A.3.5-3 presents a summary of the potential numbers of pre-nesting spectacled eiders and spectacled eider nests affected by the hypothetical FFD in Alternative A based on pre-nesting aerial surveys and ground-based nest searches in the Colville River Delta and in the NPR-A portion of the Plan Area proposed for development in CPAI Alternatives.

TABLE 4A.3.5-3 FFD ALTERNATIVES A-D – POTENTIAL SPECTACLED EIDERS DISPLACED BY HABITAT LOSS OR ALTERATION AND DISTURBANCE

	Gravel	Dust	Ice	Airstrip[a]	Total
FFD Alternative A Totals					
Pre-nesting	0	0	0	1	1
Nesting	1	0	0	3	4
FFD Alternative B Totals					
Pre-nesting	0	0	0	1	1
Nesting	1	0	0	3	4
FFD Alternative C Totals					
Pre-nesting	1	0	0	0	1
Nesting	1	1	0	0	2
FFD Alternative D1 Totals					
Pre-nesting	0	0	0	2	2
Nesting	1	0	0	6	7
FFD Alternative D2 Totals					
Pre-nesting	0	0	0	1	1
Nesting	1	0	0	3	4

Notes:

[a] Disturbance at airstrips would potentially reduce nesting by 50% within 500 meters of airstrip for waterfowl, loons, and seabirds (Johnson et al. 2003b)

Colville River Delta Facility Group

Habitat Loss and Alteration.

In addition to habitat loss described under Alternative A for the ASDP, there would be additional habitat loss it the Colville River Delta for airstrips associated with the hypothetical CD-14, CD-19, CD-20, and CD-21 sites. Short gravel roads would connect the CD-2 and CD-4 sites of the ASDP with CD-12 and CD-11, respectively. CD-15 would be connected by a road system to Nuiqsut and the existing Alpine Development.

Pre-nesting spectacled eiders are concentrated in the northwestern portion of the Delta north of the hypothetical CD-12 and CD-14 sites and west of the hypothetical CD-18 and CD-20 sites (Johnson et al. 1999). For the sites proposed under Alternative A FFD, the highest pre-nesting concentrations of spectacled eiders were reported in the vicinity of the CD-12 site (Johnson et al. 1999). Based on projected gravel fill for these hypothetical facilities, 0.2 pre-nesting spectacled eiders would be affected by gravel placement, and 0.6 spectacled eider nests would be displaced.

Disturbance and Displacement.

Under Alternative A for FFD in the Colville River Delta Facility Group, aircraft traffic and noise likely would be the greatest source of disturbance to spectacled eiders. The types of disturbances would be the same as those described under Alternative A for the ASDP, but the potential impacts to spectacled eiders would be increased because of the increase in the number of airstrips.

Most displacement in Alternative A FFD would be from disturbance created by air traffic in the outer Colville River Delta. Based on a 50 percent reduction in birds and nests within 500 meters of the airstrips, 0.9 pre-nesting spectacled eiders would be displaced, and 2.8 spectacled eider nests would be displaced.

Disturbance related to vehicular traffic and machinery could also affect eiders along the access roads to CD-11 and CD-12 as well as along the short access roads from production pads to airstrips at the other sites. The road from Nuiqsut may increase the potential for local traffic to affect spectacled eiders along the access roads to the CD-2, CD-3, CD-4, CD-11, and CD-12 sites. The types of disturbances would be the same as those described above under Alternative A for the ASDP sites. Disturbance to spectacled eiders from vehicular traffic and other associated road disturbances would be most likely to occur at the CD-12 site and the proposed access road to CD-12, where spectacled eider concentrations are higher.

Obstructions to Movements

Under Alternative A for FFD in the Colville River Delta Facility Group, there would be little increase in the potential for the proposed development to obstruct spectacled eider movements compared to Alternative A of the ASDP. Most of the proposed sites are roadless, and there is little evidence that pipelines present more than occasional, temporary obstruction to bird movements. Short access roads would be constructed for the CD-11 and CD-12 sites, although brood-rearing eiders may be delayed in crossing. High traffic levels or high speeds on roads could pose some obstruction to spectacled eider movements if birds were displaced because of disturbance. Speed limits for vehicular traffic and machinery, especially during brood-rearing periods, could help to minimize the potential for roads to obstruct bird movements.

Mortality

Bird mortality could result from collisions with vehicular traffic, buildings, pipelines, and bridges. Potential additional mortality from air strikes could result from the additional airstrips in the outer Colville River Delta. In Alternative A FFD, traffic levels in the Colville River Delta area would be minimal because of the roadless condition of most of the project. Increased depredation pressure from predators attracted to the proposed development could increase mortality of spectacled eider eggs and ducklings. This could be minimized with proper handling of garbage and educating oilfield workers about the problems associated with feeding wildlife. Road access from Nuiqsut might allow for increased local traffic and increased subsistence hunting pressure and increased spectacled eider mortality near the CD-2, CD-3, CD-4, CD-11, and CD-12 sites.

Fish-Judy Creeks Facility Group

Habitat Loss and Alteration

Habitat loss and alteration could occur in the Fish-Judy Creeks Facility Group from gravel placement for access roads and production pads. In the area of Fish and Judy creeks, the highest concentration of spectacled eiders was reported near the hypothetical CD-8 site and in portions of the area surrounding the hypothetical CD-22 site. Spectacled eider densities are generally lower in the Fish-Judy creeks area than in the Colville River Delta area. Based on projected gravel fill for these hypothetical facilities, 0.1 pre-nesting spectacled eiders would be affected by gravel placement; and 0.2 spectacled eider nests would be displaced.

Disturbance and Displacement

Under Alternative A for FFD in the Fish-Judy Creeks Facility Group, vehicular traffic and other activities associated with the road system would be the greatest source of disturbance. In addition, noise associated with the hypothetical processing facility APF-2 could also affect birds. The mechanisms of impacts would be the same as those described above under Alternative A for the ASDP sites. The greatest potential for vehicular traffic to affect spectacled eiders would occur along the proposed access road to CD-8 and possibly in the vicinity of CD-22.

Obstructions to Movements

Under Alternative A for FFD in the Fish-Judy Creeks Facility Group, potential obstruction to spectacled eider movements could occur along the road system particularly if traffic levels are high. Traffic levels are primarily the result of industry use and could increase if the roads are open to local traffic. In general, roads do not present obstructions to bird movements. High traffic levels or high speeds on roads could pose some obstruction to spectacled eider movements if birds were displaced due to disturbance. Speed limits for vehicular traffic and machinery, especially during brood-rearing periods, may help to minimize potential for roads to obstruct eider movements.

Mortality

Other than mortality related to an oil spill (see Section 4.3), there likely would be little spectacled eider mortality related to the development in this area under Alternative A for the FFD. However, mortality could result from collisions of spectacled eiders with vehicular traffic. The potential for eider mortality associated with vehicular collisions under Alternative A for the FFD would be increased compared to Alternative A for the ASDP because of the increased road system; however, the level of mortality would probably be low compared to local populations. Reduced speed limits along roads, particularly during periods of poor visibility, may help to reduce the potential for eider collisions with vehicles.

Some mortality could also result from collisions with structures such as elevated pipelines, buildings, or bridges. The potential for mortality of spectacled eiders to result from collisions with structures under Alternative A for FFD would be increased compared to Alternative A for the ASDP because of an increase in the number of structures.

Kalikpik-Kogru Rivers Facility Group

Habitat Loss and Alteration

Habitat loss and alteration would occur in the Kalikpik-Kogru Rivers Facility Group from gravel placement for access roads and production pads, although the concentrations of spectacled eiders reported for this area were generally lower than those reported for the Fish-Judy Creeks and Colville River Delta Facility Groups. The highest spectacled eider concentrations in the Kalikpik-Kogru Rivers Facility Group were reported in portions of the areas surrounding CD-27 and APF-3. Based on projected gravel fill for these hypothetical facilities, no pre-nesting spectacled eiders would be affected by gravel placement, and 0.1 spectacled eider nests would be displaced.

Disturbance and Displacement

Under Alternative A for FFD in the Kalikpik-Kogru area, vehicular traffic and other activities associated with the road system would be a source of disturbance to spectacled eiders. Road access from Nuiqsut could increase the potential for local traffic to disturb eiders along the entire road system of the Kalikpik-Kogru Rivers area, particularly near CD-27 and APF-3. In addition, noise associated APF-3 would potentially affect eiders.

Placement of the airstrip for CD-29 would increase potential disturbance to spectacled eiders. Based on a 50 percent reduction in birds or nests within 500 meters of the airstrip, no pre-nesting eiders would be disturbed, and 0.1 spectacled eider nest would be displaced.

Obstructions to Movements

Under Alternative A for FFD in the Kalikpik-Kogru rivers area, potential obstruction to spectacled eider movements would occur along the road system, particularly if traffic levels are high. Traffic levels are primarily the result of industry use and could increase if roads are open to local traffic.

Mortality

The potential for impacts of the FFD under Alternative A to affect spectacled eider mortality in the Kalikpik-Kogru Rivers Facility Group would be similar to that discussed above for the Fish-Judy Creeks Facility Group. The airstrip at CD-29 would increase the potential for mortality from collisions with aircraft. The potential impacts may be reduced compared to those for the Fish-Judy Creeks area because of the reduced amount of infrastructure and lower densities of spectacled eiders in the Kalikpik-Kogru rivers area. Road access from Nuiqsut could increase the potential for subsistence hunting to affect spectacled eiders along the entire route of the road system in the Kalikpik-Kogru Rivers area.

Alternative A – Summary of Impacts (CPAI and FFD) on Spectacled Eider

Most impacts to spectacled eiders resulting from CPAI Alternative A would occur in the Colville River Delta Facility Group and would be limited to a few individuals. Spectacled eiders occur in greater numbers near proposed developments in the Colville River Delta than in the NPR-A portion of the Plan Area.

CPAI Alternative A would potentially displace less than one pre-nesting spectacled eider and one spectacled eider nest.

Impacts from FFD Alternatives A through D for spectacled eiders are summarized in Table 4A.3.5-3.

Alternative A – Potential Mitigation Measures (CPAI and FFD) on Spectacled Eider

Potential mitigation measures would be similar for the CPAI Development Plan Alternative A and the FFD Alternative A. Mitigation measures protective of bird habitats are presented in Section 4A.3.1.

Obstructions to Movements

Traffic speeds on roads would be reduced during brood-rearing.

Mortality

Spectacled eiders would be hazed away from active airstrips to prevent collisions with aircraft.

4A.3.5.3 Steller's Eider

This section describes the potential impacts of the ASDP on threatened Steller's eiders. Impacts to other bird groups associated with the proposed development are described in Section 4A.3.3 and can be referred to for more detailed description of the mechanisms of specific impacts. In general, impacts to Steller's eider potentially are the same as those described for the spectacled eider under all of the alternatives. However, the likelihood of impacts occurring to Steller's eider is very small, even under FFD scenarios, because they occur very rarely in the Plan Area. There would be a loss of potential Steller's eider habitat from the ASDP. Given the current distribution of Steller's eider in the Plan Area, it is unlikely that any of the project alternatives would affect this species.